The FOUNDRY

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Columbus Meeting Sets New Record

Large Attendance and Intense Interest in the Technical Programs and Exhibit of Equipment Mark the Twenty-fifth Anniversary —Veterans Endow Distinguished Service Awards

EACH succeeding year in the history of the American Foundrymen's association has set a new record in some if not all phases of the convention and exhibition. Last year the meeting at Philadelphia was thought to have reached the ultimate limit. It was said that the gathering in the Quaker city had established a mark in attendance and interest which never again would be surpassed, but the convention which has just closed at Columbus has transcended last year's meeting in the point of attendance, variety of exhibits and in the interest and authoritative scope of the technical sessions. The registered attendance this year exceeded 3800, and inasmuch as the number who register is always about 40 per cent short of the total number present, it is safe to estimate that between 5000 and 6000 members and guests were at the technical sessions and attended the exhibition during the week. While the foreign registration at Columbus did not nearly approach that which was noted in Philadelphia last year, still a great many were present from abroad. These in most cases were executives whose purpose in this country was to become acquainted with American methods and equipment. The State Fair grounds at Columbus proved ideal for the purposes of the exhibition. Never before has it been possible to house this huge affair with such convenience to the visitor whose time is limited. Seven large buildings were grouped in such a manner that it was possible to view each in succession, and then to go to that section in which was grouped the eequipment or supplies which it was desired to study more in detail. In this manner if a visitor were in search of molding machines, he would find gathered together in one building all that equipment which represents the best practice in modern molding machine manufacture. On the day preceding the opening of the exhibition, the last of the remaining spaces were allotted. Every booth which had been planned originally was taken and yet there were no applications for space which were refused by the association. Over 75,000 square feet of area was filled to capacity with the different displayes. This amount was 25 per cent in excess of the space which was occupied at the Commercial Museum in Philadelphia last year. Never before have the foundrymen found such a complete program on nonferrous subjects. From the open-

W. R. BEAN

W. R. Bean, whose election as president of the American Foundrymen's association is announced elsewhere in this issue, was born in 1879 in Virginia. As a boy, he first worked in the mines of the Princess Iron Co., Glen Wilton, Va., of which his father was superintendent. Later, he attended and was graduated from the Virginia Polytechnic Institute, subsequently becoming an apprentice wtih the Atlantic Coast Line railway. Following the completion of his apprenticeship, he went to the T. H. Symington Co., Baltimore and Rochester, N. Y., as draftsman, inspector, superintendent and works manager, successively. From 1901 to 1913, Mr. Bean was engaged in investigation and consultation work, visiting many foundry plants. Later he studied the methods of fuel burning and continued in this work until 1916, when he became research engineer of the Eastern Mallable Iron Co., Naugatuck, Conn., which position he now holds.

ing session Tuesday morning until the final meetings Friday, the attendance was large. At the banquet Wednesday night, over 400 listened to the address of Representative Simeon D. Fess and heard for the first time the announcement of the endowments which have been made to advance the science of foundry practice. The smoker and ladies theater party the following evening marked the close of the social features of the convention. The morning session, Oct. 5, was opened by Dr. Richard Moldenke, Watchung, N. J., who read a paper on the ferroalloys useful for purifying cast iron with particular reference to zirconium. He submitted a list of elements named in order of their probable susceptibility to oxidation. The more stable elements range from phosphorus, sulphur, iron, copper, nickle, tungsten, molybdenum to carbon, which is about midway in the scale. Continuing in the order of the elements more easily oxidized are carbon, chromium, zirconium, silicon, manganese, vanadium, aluminum, magnesium, titanium and cerium. The reasons for insisting on good melting practice to economize in the use of expensive ferroalloys was gone into quite extensively by the speaker and in the discussion which followed the subject of cupola practice was dealt with An interesting paper by Lieut. R. F. Nourse was read in the absence of the author by R. E. Kinkead, Cleveland. The paper dealt in detail with the appointments and facilities of the repair shop maintained on board the U. S. S., PROMETHEUS repair ship of the Atlantic fleet, The machine shop is equipped with 24 lathes, 4 milling machines and many other machine tools. The foundry has six tilting brass furnaces and three cupolas. After describing the foundry and its equipment the paper showed the production record of the foundry during the period of the war. The largest single iron casting made weighed 2100 pounds and the output during November 1918 aggregated nearly 32 tons. In conclusion the speaker explained the personnel of the foundry organization. The manufacture of milling machine castings as practiced at the plant of the Brown & Sharpe Mfg. Co., Providence, was explained in a paper read by LeRoy M. Sherwin of that company.

"Electrical Apparatus in a Modern Iron Foundry," was the subject of a paper illustrated by a number of lantern slides presented by F. D. Egan. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

George K. Elliott, Lunkenheimer Co. Cincinnati read a paper on the electric furnace and the problem of sulphur in cast iron. The speaker expressed the opinion that the sure tendency of sulphur to segregate constitutes the greatest menace of high sulphur. He admitted that it is impossible to fix positively any pronounced advantage in iron with 0.015 or 0.030 per cent sulphur over those with twice that amount; but he said there is a speculative satisfaction in knowing that the limits achieved in everyday practice are safe. Instead of striving for low sulphur limits the speaker was of the opinion that the use of more scrap or of pig iron running comparatively high in sulphur will become popular. One of the most instructive papers read at the convention was by A. N. Kelly, Modern Foundry, Cincinnati. It was illustrated by a number of lantern slides and treated in detail of the manufacture of machine tool castings by comparatively unskilled labor. Patterns and equipment are elaborate and extremely accurate and the molding and melting practice are designed to produce a line of high grade castings. An interesting detail of manufacture lies in the employment of chills coated lightly with linseed oil then dusted with silica sand and dried in the oven.

The afternoon session resolved itself into an informal round table discussion on cupola practice lead by Dr. Moldenke.

The general session of the American Foundrymen's convention on Friday, Oct. 8, presided over by C. R. Messinger, Sivyer Steel Casting Co.,

Establish Awards for Industrial Service

STANDING out strongly above the many features which mark the twenty-fifth annual convention of the American Foundrymen's association is an act of devotion to the industry which will serve to make the gathering memorable. Since its inception, in Philadelphia, the association has made many notable contributions to the advancement of scientific foundry knowledge. These have been the best fruits of research and practical experience and have been offered freely to all through the society; those who have been the pioneers in progress being unselfish in their efforts to serve all foundrymen. In recognition of this distinguished service to the industry and to offer an incentive towards further advancement, a group of veterans of the association has perfected a means to recognize those who further foundry knowledge. Announcement was made at the banquet Thursday, Oct. 7, of six substantial gifts, which had their inception in an idea suggested last year at the Philadelphia meeting by John A. Penton, the first secretary of the association. These gifts which have been accepted and will be administered by the directors are as follows:

From J. H. Whiting, $5000, the income from which will provide an award for the most outstanding development in processes of melting iron or steel in any type of furnace other than an electric furnace.

From W. H. McFadden, $5000, to furnish an endowment for an award, the terms of which will be decided by Mr. McFadden and the executive committee of the association.

From W. S. Seaman, $5000, which will provide an income to be applied in rewarding some noteworthy contribution to foundry knowledge, the terms of which will be decided by Mr. Seaman and the executive board of the association.

S. Obermayer Co., $1000, the income from which will be used to provide each year some form of recognition of scientific achievement, the details of which are to be decided later.

Thomas W. and John C. Pangborn, $2500, which is to be applied toward the advancement of scientific knowledge of foundry practice in any way which may be decided.

From John A. Penton, $5000, the income from which will be applied each year to provide an award which will be presented to that individual who shall as the result of study, research or experiment contribute to the industry the most notable improvement in the process of melting or refining ferrous or nonferrous metals by the use of the electric furnace.

Milwaukee, was opened by H. C. Boyden, Portland Cement association, Chicago, who read a paper on the subject of concrete floors for foundries. Among the advantages of concrete molding floors, according to the speaker, are ease of shoveling molding sand, incentive to keep the shop in an orderly condition, economy in the use of sand since it does not get mixed with floor dirt, etc.

In response to a question from one of the members regarding the desirability of mixing iron borings with the top layer of concrete the speaker expressed the opinion that such a course of action was not necessary. If the concrete is mixed properly, and by properly is meant leaving it for at least one minute in a mechanical mixer and turning it over at least five times if mixed by hand, the floor will be hard and firm enough for all practical purposes. C. H. Gale, Pressed Steel Car Co., McKees Rocks, Pa., presented a paper containing the report of the committee appointed by the president of the American Foundrymen's association to act in conjunction with the American Engineers Standards committee. This committee acting in unison with a similar committee from the National Founders' association, had submitted for approval the code adopted for safety, sanitation and fire protection by those two associations in 1917. It is now before the American Engineering Standards committee for consideration. During the past two years a well organized movement has been under way to bring together the various parties to formulate a single safety code to apply with modifications to all branches of industry and according to the report satisfactory progress is being made in this respect.

"The Equipment of the Foundry—Today and in the Near Future," was the subject of a paper presented by H. R. Atwater, Osborn Mfg. Co., Cleveland. According to the speaker the work now being done in installing modern labor saving equipment in foundries is only the start of a movement which will expand in the next five years.

A. W. Gregg, Whiting Foundry Equipment Co., Harvey, Ill., read the paper prepared by David McLain, McLain's System, Milwaukee, Wis., on the care of foundry equipment. The paper covered practically the same ground as that presented by H. R. Atwater with the difference that it was prepared in a different manner. The author adopted the novel plan of presenting in conversational form the difficulties in a foundry and machine plant where a well meaning foundry superintendent is not properly backed up by the proprietor and manager.

C. R. MESSINGER

C. R. Messinger has been taken from the board of directors of the American Foundrymen's association and elected to serve as vice president during the coming year. Mr. Messinger was graduated from the scientific course of Yale university in 1906. After leaving college he began work with the Sivyer Steel Casting Co., Milwaukee, and became general manager of that company in 1909. A few years later in 1916 Mr. Messinger became vice president and general manager of the Chain Belt Co., Milwaukee, and in 1916 accepted the position of secretary of the Federal Malleable Co., Milwaukee. At present Mr. Messinger holds the position of vice president and general manager for both the Sivyer Steel Casting Co. and the Chain Belt Co. He is also vice president of the Federal Malleable Co., and treasurer of the Interstate Drop Forge Co., Milwaukee, as well as director of the Electric Steel Casting Co., Chicago.

E. F. Cone, *The Iron Age*, New York, presented a paper, "The Status of the Electric Furnace in the Foundry Industry." Of the 759 electric furnaces in use or contracted for in September of this year in the United States and Canada, 33 1/3 per cent are engaged in the production of nonferrous metals and 50 per cent in the steel industry.

The paper prepared by H. Cole Estep, European manager of the Penton Publishing Co., entitled "Notes on European Molding Machines," was read in abstract from by E. L. Shaner, engineering editor, *The Iron Trade Review*, Cleveland. In the discussion which followed, C. R. Messinger, Sivyer Steel Casting Co., Milwaukee, referred to the fact that his company has built and equipped a European malleable plant similar to the one they operate in this country; but that while the output per man in the American shop averaged 400 pounds a day, the European production only reached 160 pounds. He stated that with anything like a favorable freight rate American manufacturers could lay down malleable castings in England and other European countries at a profit. Notwithstanding that not all efficiency engineers really promoted efficiency during the period when efficiency engineering was a fad, the influence of those engaged in the profession aroused the interest of foundrymen to the posibilities of improved methods was the theme of the paper presented by Frank D. Chase, Frank D. Chase, Inc., Chicago. Industrial engineering which followed efficiency engineering recognizes the necessity of scientific analysis of the problems of plant layout and design to the end that a plant can be built to fit its operating requirements. He emphasized the necessity of making the foundries attractive to the workers and at the same time designing the plant so that the production possibilities of each department can be developed to the utmost. The necessity for understanding the process of welding and taking precautions to see that each job is well done was emphasized in a paper on welding by A. M. Candy, Westinghouse Electric & Mfg. Co., East Pittsburgh. Mr. Candy said that poor welds are sometimes made in steel castings on account of the cavity to be welded not being cut wide enough to allow the arc to heat the metal thoroughly in the base of it. Slides were shown to illustrate different points brought out by the speaker. Welds made with rods of cold rolled steel and with Norway iron were shown, in contrast with welds made with mild steel rods, to illustrate the necessity of a suitable

welding material. Oxidation was clearly in evidence in the welds made with Norway iron while the welds made with mild steel were solid throughout. Effects of a short arc were compared with welds made with a long arc and showed the former welds to spread less over the surface and to penetrate deeper. Welding cast iron with steel rods was said to produce a high carbon steel at the point where the two metals join owing to the steel from the rod absorbing carbon from the iron. This section then chills when the weld is cooled, and a hard spot is formed. To overcome this a nickel steel alloy or even pure nickel is used with success. In closing Mr. Candy said that welding is not a cure-all and should not be used indiscriminately as there are certain places where welded castings should not be used in any case due to the danger arising through an insulficient factor safety.

Steel Sessions Develop Keen Interest

MANY phases of the steel casting industry, from the molding side to the latest development of heat treating steel castings were discussed at the two sessions devoted to this branch of foundry work. Past president, R. A. Bull presided at the first session held Tuesday afternoon, Oct. 5. Tests made to determine the best kind of sand to use for steel castings were presented in a paper on molding materials for the steel foundry by R. L. Lindstrom, Canadian Steel Foundries, Ltd., Montreal, Canada. Scarcity of molding materials in Canada caused this company to endeavor to find a suitable material in that country and a number of rather simple tests were developed. It soon was found that chemical analysis would not determine the adaptability of a clay for bonding purposes, and a test was developed in which a sand mixture was made and a standard test piece formed from the mixture. This test block, 1 x 1 x 12 inches, was then placed on a glass plate and pushed lengthwise over the edge until the end broke off. The average length of such ends from a number of tests was taken as an indication of the strength of the mixture. Porosity tests were also made as well as microscropic examinations of the sands. In the discussion the author said that sands with rounded grains produce a smoother surface on castings than sands with angular grains. The latter were said to split into dust in use and reduce the venting power of the mixture. Cleavage planes were shown in the angular grains in one of the author's illustrations and these were cited as a cause for the splitting of such grains. In reply to a question by Mr. Bull the author stated that he did not find that high silica content lowered the fusing point of clay. H. M. Bougher, J. W. Paxson Co., Philadelphia, called attention to the use of clay from the Welsh mountains in eastern Pennsylvania which contains 85 per cent silica. Objection to the use of the Welch mountain was stated by K. V. Wheeler, Lebanon Steel Foundry, Lebanon, Pa., to rest in the increased time required to mill it.

R. B. Farquhar Jr., Electric Steel Co. of Indiana, Indianapolis, discussed pouring, gating and feeding steel castings, calling attention to the advantages and disadvantages of using bottom pour, lip, teapot and bull ladles, as well as giving rules for gating and feeding. The author spoke of the advantage of water-cooling casting and cited tests of heat treated castings in comparison with tests of forgings which the castings supplanted. One of these tests of heat treated unalloyed cast steel showed a tensile strength of 106,350 pounds per square inch, elastic limit 70,600 pounds per square inch with 19 per cent elongation and 30.7 per cent reduction of area.

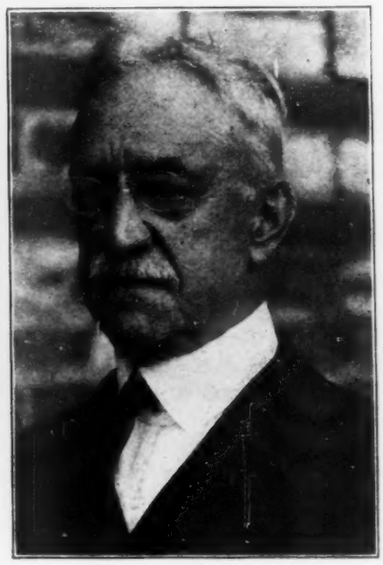
A plea was made for standardization in the design and construction of patterns for small steel castings in a paper presented by K. V. Wheeler. That many customers order a few castings from a poor pattern and later send large orders for this casting without furnishing a suitable pattern on the plea that castings had been made off the original pattern was one reason advanced for having standards for patterns.

The progress report of the committee

Three of the Donors of Research Awards

W. H. McFADDEN

W. S. SEAMAN



J. H. WHITING

on steel foundry standards made by Chairman W. A. Janssen, American Steel Foundries, Chicago. Mr. Janssen explained that the association has a committee to act with similar committees of several other technical organizations to formulate standard marking of patterns. Mr. Janssen deplored that standards adopted at different times by the association never have been generally adopted owing to no proper means being adopted to introduce and back them.

As has been mentioned the second session devoted considerable attention to discussing heat treatment of steel castings. "Heat Treating Steel Tractor Castings," by Fred Grotts, Holt Mfg. Co., Peoria, Ill., was read by title in the absence of the author. The application of the electric furnace to heat treating steel castings was dealt with in a paper by E. F. Collins, General Electric Co., Schenectady, N. Y. The statement was made that the electric furnace with its automatic control and freedom from oxidizing gases offered opportunity for a more uniform anneal at not too excessive cost. This paper is presented in full on another page of this issue.

A. W. Lawrence, the Bucyrus Co., South Milwaukee, Wis., stated in reply to the statement that quenching and drawing castings is only a theoretical problem that his company has found that this treatment pays for certain castings made by them and that it is practiced regularly.

That castings annealed with pulverized coal acquire carbon and sulphur during the process was stated in a paper by C. H. Gale, Pressed Steel Car Co., Pittsburgh. Figures are given which indicate that on the first anneal the carbon and sulphur acquisitions penetrate only the outer portion of the casting but on subsequent anneals are driven toward the center. The castings were annealed in a furnace without a combustion chamber. The absorption of carbon is shown to increase the strength of the casting and lower its elongation.

E. R. Young, Detroit Steel Casting Co., Detroit, presented a paper in which he gives definite rules for making test bars to meet specifications and Henry Traphagen, Toledo Steel Casting Co., Toledo, said that the proper method is not to inspect the test bar so closely but to gage the work by the foundry operation and equipment as poor castings can be made with good test bars attached and the customer does not want the test bar but the casting.

That agreement has not been reached as to the proper method for operating the electric furnace in melting steel was indicated by the discussion which followed the paper on acid electric steel by James W. Galvin and Charles N. Ring, Ohio Steel Foundry Co., Springfield, O. One member present disagreed with the authors' statement that increased insulation efficiency should be obtained in furnaces, as he said this would cause breaking down of the refractories. Another took exception to the use of a deep bath as advocated.

Officers of the A. F. A.

President:
W. R. BEAN,
Eastern Malleable Iron Co., Naugatuck, Conn.

Vice President:
C. R. MESSINGER,
Sivyer Steel Casting Co., Milwaukee.

Secretary-Treasurer:
C. E. HOYT,
Chicago.

Directors

One-year term

G. H. Clamer, Ajax Metal Co., Philadelphia.
Fred Erb, Packard Motor Car Co., Detroit.
B. D. Fuller, Defiance Paper Co., Niagara Falls, N. Y.
C. E. Hoyt, Marquette building, Chicago.
Lucien W. Mueller, H. Mueller Mfg. Co., Decatur, Ill.

Two-year term

H. R. Atwater, Osborn Mfg. Co., Cleveland.
S. B. Chadsey, Massey-Harris Co., Ltd., Brantford, Ont.
Alfred E. Howell, Nashville, Tenn.
S. T. Johnson, S. Obermayer Co., Chicago.
J. P. Pero, Canadian Car & Foundry Co., Amherst, Nova Scotia.

Three-year term

A. O. Backert, Cleveland.
R. A. Bull, consulting engineer, Sewickley, Pa.
W. A. Janssen, American Steel Foundries, Chicago.
C. S. Koch, Fort Pitt Steel Castings Co., McKeesport, Pa.
V. E. Minich, American Foundry Equipment Co., New York City.

Present Questions of Employing Men

IT IS doubtful whether any session ever held before by the foundrymen's association has been received as enthusiastically as that devoted to industrial relations held Wednesday afternoon. Between 500 and 600 foundrymen listened to a group of several speakers, each of whom had a real message and knew how to deliver it with more than usual effectiveness. Arthur H. Young, International Harvester Co., Chicago, presided, and by his able handling of the program contributed much to the success of the meeting.

Meyer Bloomfield, *Bloomfield's Labor Digest*, Boston, presented an urgent plea for better relations between employer and employe. He first pointed out the need for sharp definition in dealing with the subject that is vaguely called industrial relations. This, he said, is not wholly the fault of any individual and although some may deal with it with an air of finality, the truth is that the subject itself must remain for a long time incapable of mathematical exactness of statement.

In a paper entitled, "Training Foundry Executives," R. E. Kennedy and Bruce Benedict, University of Illinois, Urbana, Ill., made a plea for the co-operation of foundrymen with the technical schools of the country to the end that the course of training for foundry executives might be improved. Mr. Kennedy described the plan now followed at Illinois, in which the students are given an opportunity to participate in all positions in the foundry from the laboring and clerical jobs up to the executive and staff positions. This plan, as outlined in the paper, will appear in a later issue of THE FOUNDRY.

Students Good Material

Mr. Benedict brought out that 5 per cent of the students received for training in foundry work are natural leaders and that the foundrymen as prospective employers of these men should have something to say about the way the men are trained. Following discussion which further emphasized the need of co-operation along the lines outlined by the speakers, A. O. Backert, Penton Publishing Co., Cleveland, proposed that a committee be appointed to investigate the foundry training facilities of the various technical schools of the country with a view to ascertaining which is best suited to receive the co-operation of the association. This motion was carried.

The outstanding address of the afternoon was delivered by Dr. Charles Prosser, Dunwoody institute, Minneapolis, on the foreman's relationship to the worker. He paid a high tribute to the foremen of the old school, who was a natural leader of men and who held his job because of his ability to handle them. The foreman of earlier days, he said, lived with his men and by his intimate relations with them stood midway between the employer and employe and yet was trusted and respected by both To the men the foreman represented the spirit and policy of the management and to the employers he played the role of special agent for the men. Coming up from the ranks, he was in a position to sympathize with the men and to judge their demands, knowing from his own experience when their requests were sincere. By sheer force of personality he often endeared himself to his workers so that when he said, "Now boys, let's get to work and clean up this job in a hurry," they buckled down to the task cheerfully and actually down to the task cheerfully and enjoyed the satisfaction of doing a job well.

In the absence of Fred H. Ringe, John R. Dyer, Y. M. C. A., New York, showed by actual demonstration how foreign born workmen can be taught simple English in a short space of time. A dozen foreigners were brought in from the plant of the Buckeye Steel Castings Co., Columbus, for the demonstration. An interpreter first explained to them the purpose of the test, after which Mr. Dyer went through the motions of awaking from sleep, opening his eyes, looking for his watch, finding his watch and seeing what time it was. After each movement he explained his act in a simple sentence as, "I awake from sleep"; "I open my eyes"; "I look for my watch"; etc. He then asked the men to repeat these sentences, one at a time, in unison. Later he had each man repeat each sentence alone. When they became proficient in this, he asked them to state the sentence corresponding to his actions, as he again went through the movements previously enacted.

Dean C. B. Connelley, department of commerce and labor of Pennsylvania, Harrisburg, Pa., presided at the Thursday morning session on industrial relations. The first speaker, M. C. Evans, International Harvester Co., Chicago, discussed the development of the foreman, treating the subject from a somewhat different angle than that by which Dr. Prosser approached it on Wednesday. Mr. Evans outlined the arrangement of foremen's development course conducted for the foremen of the Harvester company.

"The Right Man on the Right Job" was the title of an unusually practical paper presented by A. H. Young, International Harvester Co., Chicago. Mr. Young's paper will be presented in full in a later issue of THE FOUNDRY, but it can be said that he devoted much attention to the work of the employment department in properly choosing men and introducing them to their new jobs. He traced the development of employment departments from the beginning when they supplanted the old system whereby the foreman hired his men as needed.

Consider Problems of Brass Foundries

THE interest which the American Foundrymen's association always has displayed towards the nonferrous sessions conducted by the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, took a more active form at Columbus, aid being extended by the former society in getting papers on nonferrous subjects which it was felt would be especially attractive to those brass foundrymen interested in the practical side of their business.

Three sessions dealing with nonferrous subjects were held and two of the three were joint sessions. The first joint meeting was held Tuesday afternoon, Oct. 5th, and the first paper on the list was entitled "Investigation of Brass Foundry Fluxes" by C. W. Hill, T. P. Thomas, and W. B. Vietz, Pittsburgh, Pa. The authors divided fluxes into three classes. The first are those substances which are added to molten metals to remove small amounts of impurities accidently introduced after the metal had been previously refined. The second class comprises the deoxidizers, so-called, which act to reduce the metallic oxides present. The third class includs the sustances used primarily to protect the surface of the metal, such as lime, fluorspar, soda ash and other materials. The real action of all such fluxes is physical in nature, also largely mechanical. At the points of contact of flux and metal, the rapid evaporation of the flux may operate to break the film that insulates the metal and keeps each droplet from coalesing and sinking into bath. Some such action probably occurs when zinc chloride is mixed with the dross that forms on the surface of molten aluminum. The discussion brought out that experience with such fluxes as borax, and soda ash, has shown them to be destructive of crucibles and that a mixture of charcoal and broken glass made an efficent flux.

GUILLIAM H. CLAMER, newly elected director of the American Foundrymen's association, ranks as one of the foremost metallurgists of the world in the nonferrous casting industry. Mr. Clamer was graduated from the University of Pennsylvania in 1897 and became associated with the Ajax Metal Co., in the capacity of chemist. In 1898 he began the study of metallography and was counted among the pioneers in the metallographic study of the nonferrous metals. As a result of his investigations he was presented with the Elliott-Cresson gold medal which is the highest reward of the Frankling institute. Mr. Clamer has been for a number of years actively associated in an official capacity with many of the leading technical societies which are in existence in the United States and England.

Another paper was "The Laboratory Testing of Sands, Cores and Corebinders," by F. L. Wolf, and A. A. Grubb, Manfield, Ohio. Methods of testing cores and core sands are described. The laboratory test precedes the foundry test and the two tests are always made preliminary to placing orders for materials. Sand is examined first under a low power microscope, and then is tested for fineness, porosity, and permeability For reasons given, the fineness tests are made with screens from 200 mesh down, instead of 100 mesh down. Porosity is not so important as permeability, the latter meaning the measure of freedom with which gas passes through the sand. A water column aspirator is used to measure the permeability of baked cores, and valuable information has been obtained by its use. The gas content of the cores also has been measured. This is the amount of gas that will come off when the metal is poured around the core, and which must be carried off through vents. The method of measurement consists in determining the per cent loss of weight of a core, when heated to 1400 degrees Cent., 2552 deg. Fahr., in an electric furnace. It has been found that most commercial core oils make cores that run considerable higher in gas content, than straight linseed oil. The discussion centered largely on the fact that sands vary greatly in the amount of oil required to bind them. Some require one part oil to 40 parts sand, while others make strong cores when the proportions are one of oil to 70 sand. Some stated this is due to the fact that where the most oil was

required, the sand was decomposed and more porous.

"The Reclamation of Metal from Brass Foundry Refuse," was the title of an interesting paper by F. L. Wolf and J. E. Anderson, Mansfield, Ohio. This paper which will be presented in a forthcoming issue of THE FOUNDRY, described a reclamation plant in operation in a large brass foundry in Ohio. The refuse is passed through two treatments the first a screening, crushing, and hand picking operation, to remove large pieces of both metallic and nonmetallic constituents. In the second operation, the fine material is concentrated, that is the nonmetallic materials are removed to as large an extent as is possible. This is done by regular concentrating equipment, consisting of jigs, bins, elevators, ball mills and converting table. Flow sheets are given for both the preliminary treatment and the concentrating, operation. The returns are large and amply pay for the labor and expense of the reclamation plant. The discussion brought out that ordinary reclamation methods fail to recover all the metal; about one per cent remaining in the tailings. G. H. Clamer stated that a large percentage of this metal is in the form of oxides and was unrecoverable by mechanical separation methods but might be recovered by ammonia leaching though he doubted whether this would be feasible, owing to the cost.

A paper describing a new method of making phosphor copper, by P. E. Demmler, East Pittsburgh, Pa., described a method devised by the author for making this alloy, which in a number of features resembles a method of analysing phosphuretted hydrogen by passing the gas over copper turnings in a tube heated to redness. In this process phosphorous vapor is passed over finely divided heated copper in a suitable apparatus. The advantages of the process are largely manufacturing advantages. The copper need not be melted until it is converted into phosphor copper the phospohorus is not handled, and the loss is small, whereas with the common methods it reaches fifty per cent. The discussion developed that the alloy becomes unstable when the phosphorous content exceeds 15 per cent, that, therefore, this percentage of phosphorous, or under, makes the most permanent alloy.

"Recent Developments in Die Casting," by Charles Pack followed. This paper will appear in a latter issue of THE FOUNDRY. "The Solubility of Hydrogen in Molten Copper Alloys," by C. W. Hill, T. P. Thomas and G. P. Lucky concluded the first session.

The first paper presented Wednesday morning was, "Casting Losses in the Aluminum Foundry," by Robert J. Anderson. This paper which in amplified form will later appear in Tœ5 FOUNDRY contained some very interesting facts.

A short paper entitled "Pouring Temperature as Affecting Casting Shrinkage and Solidity," by R. R. Clarke, brought out a most interesting discussion. Mr. Clarke advocated "hot pouring" and in an extemporaneous extension of his remarks gave examples showing the hot pouring castings of large diameter, in the form of solid cylinders, and known as, pin brass, could be made perfectly solid by the use of gates and risers much smaller than commonly advocated. There was a divergence of opinion on the subject of hot pouring, and instances were given where such practice had been detrimental and apparently had resulted in producing castings that leaked under air pressures, also castings that split after the sand chilled outer surfaces had been machined away.

LUCIEN W. MUELLER, newly elected director of the American Foundrymen's association, has been actively associated with the foundry industry on the nonferrous side for a number of years. Mr. Mueller's first position was with the H. Mueller Mfg. Co., Decatur, Ill., with which company he has been associated almost continuously ever since. Working up through different positions with this company, he became superintendent of foundries of the Canadian branch in Sarnia, Ont., Can. During the war he gave up his connection with the company to serve the country as lieutenant in the ordnance department, production division, United States army. After the armistice, Mr. Mueller again associated himself with the H. Mueller Mfg. Co. as superintendent of foundries being located at Decatur, Ill.

N. K. Patch stated that his investigation has proved that latter difficulty was caused by oxidized metal; in other words, by careless melting practice. Microscopic examination, he stated showed that the separation was due to a film of oxide coating the crystals along the line of demarkation. This is caused by segregation of the oxides to that part of the casting that solidifies last.

The next paper which was presented was a contribution to the subject of electric furnaces. It is entitled "A New Electric Furnace for Melting Brass", by C. H. Booth. The discussion brought out that leaded alloys with a content of lead varying from 0.25 to 30 per cent had been made successfully in electric furnaces of a type similar to the one described, with a lining lasting from 700 to 1000 heats, and even as high as 1500 heats. In one case, that of an ingot producing concern, figuring on a yearly production of 80,000,000 pounds of brass the cost of electric melting has been determined as little more than half the cost of melting in crucibles. The furnaces in the case of crucible melting, had been coke fired, while in the case of electric melting, three different makes of furnaces had been inservice . A considerable saving is effected in the case of electrical melting by charging the next days first heat into the heated furnace the night before, and keeping the metal in the furnace over night. A considerable radiation loss of heat is conserved by this practice.

The Thursday morning session of the institute of metals division of the American Institute of Mining and Metallurgical Engineers was devoted to the presentation and discusson of papers which were mostly of a highly technical character. The program included: The Charpy Impact Test as Applied to Aluminum Alloys, by E. H. Dix; Colloidal State in Metals and Alloys, by Jerome Alexander; Transition Phenomena in Amalgams, by A. W. Gray; Physical Tests on Sheet Nickel Silver, by W. B. Price and P. Davidson; and Nickel-Chromium Alloys, by Leon O. Hart.

The Charpy impact test has heretofore been applied entirely to steel but it is now proposed to adapt the test to aluminum alloys, using a smaller pendulum. This test is em-

ployed to determine the ability of the metal to withstand suddenly applied loads. A blow is struck, thus detecting brittleness or lack of toughness or ductility. It will be evident the blow must be struck with uniformity for the test to be of any value. In the Charpy method the blow is struck by a falling pendulum or hammer. The test speciman may be either notched or not, but the notched bar is almost universally used. The author showed it would appear from conclusions that the test is a useful one for aluminum as well as for steel. It was found the Charpy impact resistance of copper-aluminum alloys, decreases with increase of copper. This might be expected from elongations shown in tensile tests. The Charpy test, however, cannot be wholly relied upon in judging aluminum alloys, but it is necessary also to take into consideration the other physical properties of the metal.

The object of Mr. Alexander's paper was to show that many of the important phenomna of metals and alloys is due to the fact that at some stage metals and alloys, or some of their constituents, are in a colloidal state, and that a portion of the metal tends to remain this state at all times.

Colloid chemistry deals with the properties of the matter when exceedingly finely divided. It is defined by Wilder B. Bancroft as the chemistry of bubbles, drop grains and filments.

Malleable Industry Registers Progress

AT THE malleable session, Friday, results of extended research were given to the society. Enrique Touceda, in delivering his paper on malleable iron, compared the manufacturer of malleable with the juggler who starts to practice with two balls and as he becomes more proficient adds a ball at a time until he is able to manipulate five or six. A few year ago malleable manufacturers in general had difficulty making malleable which would meet a requirement of 40,000 pounds per square inch tensile strength, but recently daily tests of a month's production from 62 plants showed an average tensile strength of 52,561 pounds per square inch and 14.4 per cent elongation in 2 inches. Just lately a bar was sent to Mr. Touceda's laboratory which had a tensile strength of over 60,000 pounds per square inch and an elongation of 33.5 per cent. This figure the author stated would be a possibility for many foundries in the future. Efficiency of the plant organizations and improvement in equipment were the two factors which Mr. Touceda said will help the most to improve the quality of the metal in the castings. Possibilities of change in design of the melting furnaces and annealing ovens were considered. Powdered coal is recognized as an innovation in the melting process which bids fair to prove advantageous. Reference also was made to the tunnel kilns for continuous annealing, which are being installed in a few malleable foundries. One means of improving the personnel of the malleable iron foundry operation was said to be the training of technically educated men by the American Malleable Castings association. These men first are sent to Mr. Touceda's laboratory where they receive instruction in testing and metallography and get an idea of the theory of malleable iron. From there, they are sent as inspectors to the various plants of the association where they acquire a broad experience, being transferred from one plant to another. Later they are eligible for executive positions in the foundry.

FRED ERB, newly elected director of the American Foundrymen's association, has been continuously connected with the foundry industry since he was graduated from the chemical engineering course of the University of Michigan in 1908. *Mr. Erb started with the Detroit Foundry Co. and later became superintendent and general manager of that company. He left the Detroit Foundry Co. in* 1913 *and associated with the organization of the Lakeside foundry, Detroit. Shortly afterwards he took a position with the Elmira Foundry Co., Elmira, N. Y., but he soon returned to Detroit to become superintendent of the foundry division of the Packard Motor Car Co. On May* 18, 1920, *he was promoted to manager of the foundry division of that company. Mr. Erb has been connected with the Detroit Foundrymen's association for the past* 10 *years. He has served as secretary and this spring was elected president of that association for the present year.*

Mr. Touceda referred to 0.09 per cent sulphur in malleable iron as no longer being considered disadvantageous. F. J. Town, Pittsburgh Valve & Fitting Co., Pittsburgh, said he recently had a heat of malleable iron which contained 0.14 per cent sulphur, and no unusual conditions were noticed when it was machined.

In his report for the committee on specifications for malleable iron castings Enrique Touceda said that the present specifications calling for a tensile strength of 45,000 pounds per square inch with an elongation of 7.5 per cent in 2 inches apparently are satisfactory and no changes had been proposed during the past year.

A splendid paper accompanied by 40 slides showing micrographs of malleable iron was presented by W. R. Bean, Eastern Malleable Iron Co., Naugatuck, Conn. This paper was prepared by the speaker in conjunction with H. W. Highriter and E. S. Davenport of the same company. Structures of unannealed iron, of properly annealed iron, and of both under and over annealed iron were shown. The micrographs explained some things in the annealing practice but there were other points which were not cleared by the microscopic examination. Micrographs of a piece made brittle by galvanizing and having a white fracture showed an identical structure with the same piece in a normal condition before galvanizing.

After the malleable session a brief business session was held to complete the business of the convention. Many members have been added so that the membership at the close of the convention was well over 1600, a gain of approximately 50 per cent during the past year. Much credit for this growth was attributed to Alfred E. Howell, Nashville, Tenn., chairman of the membership committee.

Equipment Shows Trend of Trade

Columbus Exhibit Demonstrated Growing Interest in Labor Saving Devices—Electric Melting Units Have Developed to High Efficiency—State Fair Grounds Ideal for Exhibition

INCREASING necessity for efficient operating methods under pressure of increasing competition in the industry has commenced to exert an influence upon the machinery and equipment manufactured for foundry use. This is no place more evident than in the character of the exhibits which were shown at the Columbus equipment show. The spirit of the entire exhibition stressed features of economy and conservation.

This year's exhibition in its manner of presentation appealed to all visitors. Seven large buildings at the Ohio State Fair Grounds served to house and to group the different classes of equipment. In this way it was possible for those whose time was limited to go directly to the place in which was located those features in which they were most vitally interested. Then if opportunity availed the entire exhibition could be viewed in regular sequence.

The decided trend of the times toward installing mechanical equipment in the foundries is manifested in a striking manner by the increased interest taken by the manufacturers. While devices and appliances designed for securing accuracy of product receive a fair share of attention, greater stress seems to be placed on producing equipment that will increase the output in a given time and space.

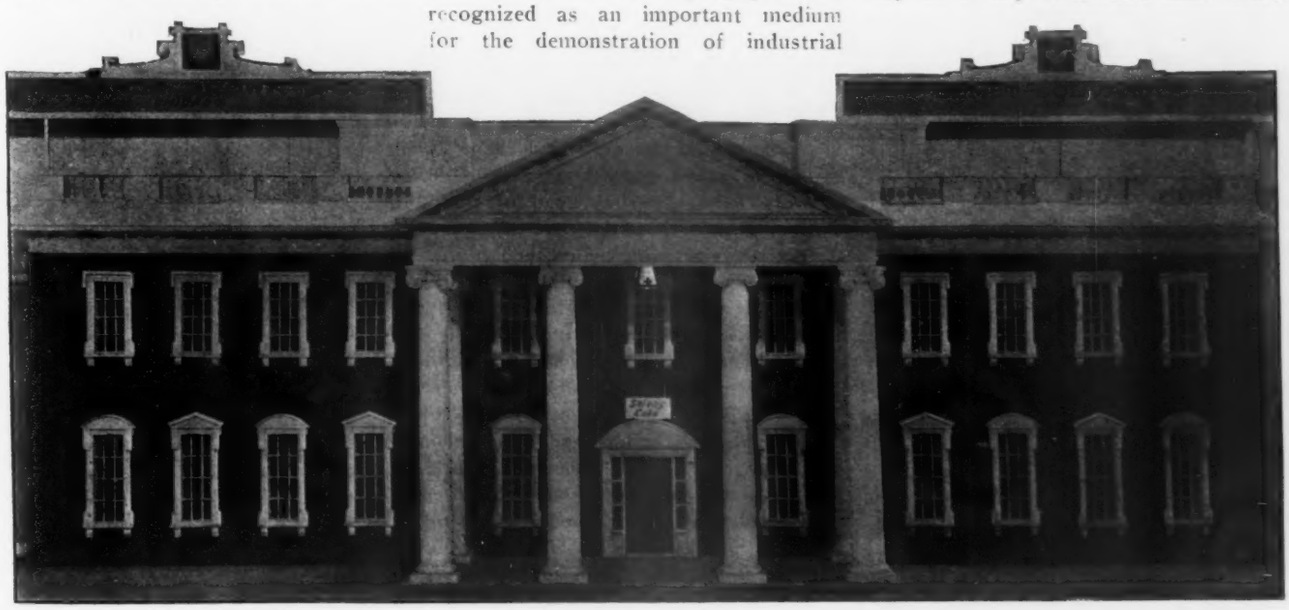
All of the molding machine manufacturers in this country have been working to capacity and all of them are behind from one to six months on their orders. Many of them make a certain number of standard sizes and run them through their factories in standard lots of from 50 to 100 They all are prepared to furnish special sizes to meet any of their customer's specifications and in addition they maintain engineering staffs who devote their time to designing changes and improvements which increase the efficiency of their machines.

In this connection it is interesting to note that while molding machines operated by hydraulic power seem to find considerable favor among European nations they are comparatively rare in this country. In fact with the possible exception of a few shops notably the continuous foundry of the Westinghouse Air Brake Co., Wilmerding, Pa., the foundries in this country favor compressed air for an operating medium. Electrically operated molding machines have been developed and placed in operation during the past few years but their adoption by foundrymen has been limited and excepting the vast number of hand squeezers the other types and variations of molding machines are operated entirely by compressed air.

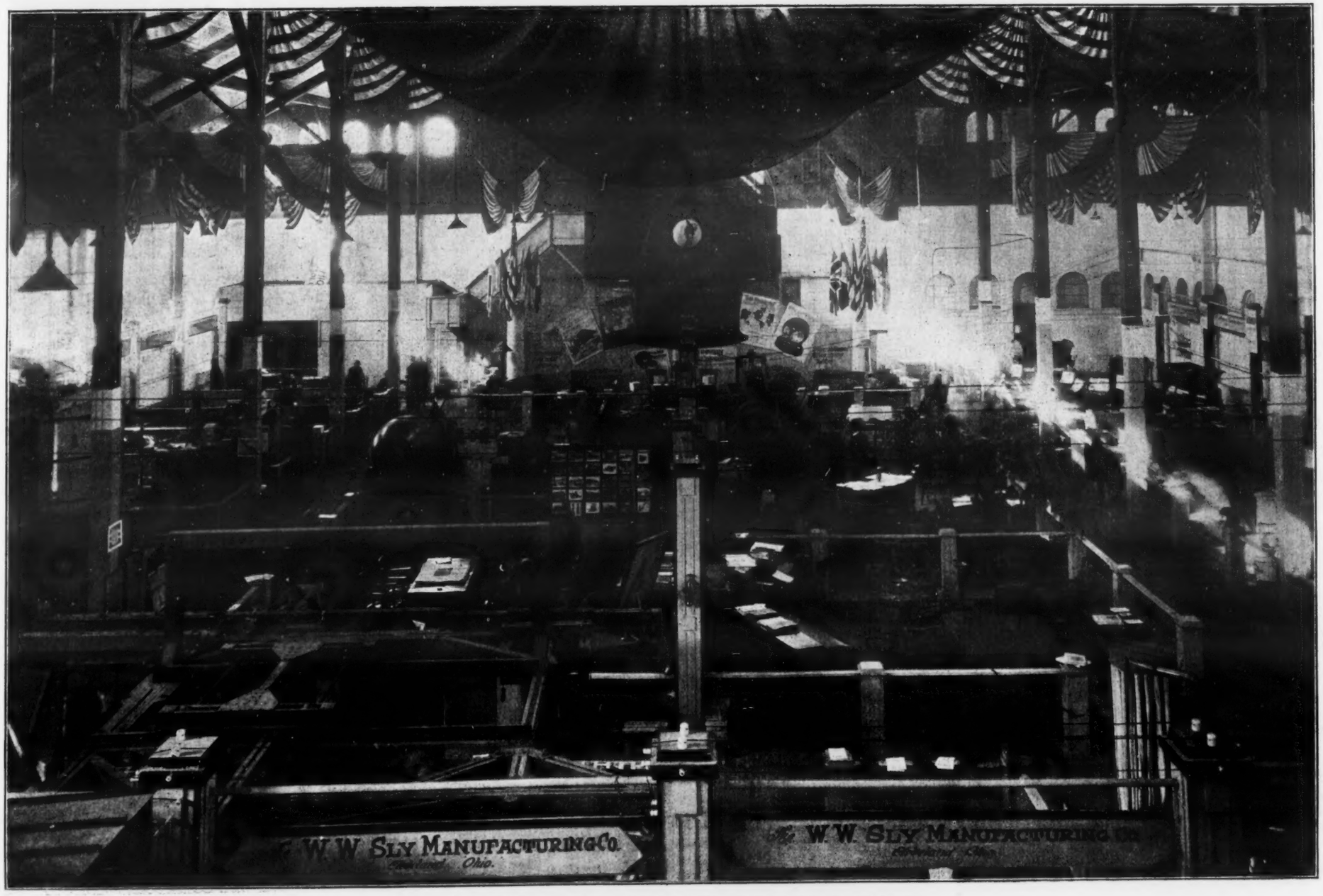
That the American Foundrymen's convention and allied exhibition by the manufacturers of foundry equipment is recognized as an important medium for the demonstration of industrial progress is evidenced by the fact that practically every firm engaged in the business was represented at the recent exhibition. Sixteen molding machine firms with their operating exhibits filled spaces ranging from one to six and seven booths.

Among the many interesting exhibits were two coremaking machines shown at one of the five booths occupied by the E. J. Woodison Co., Detroit. One of these is a new bench coremaking machine which can be bolted to any coremaking bench. The cradle will hold a core box any size up to and including 12 x 18 inches and having a draw up to 6 inches. The design has been so simplified that the machine may be operated by unskilled labor. The operator stands in one position throughout the entire process of making the core. From his bench he throws the sand into the core box, jolts it by hand, strikes off, pulls down a clamping device after which he throws the cradle a quarter turn and the box is on the plate. He then pushes a button to start the vibrator, pushes down a lever until it automatically locks and the core is drawn.

A second machine has been designed for use with split core boxes which require to be drawn sideways. This machine will draw split coreboxes up to 8 inches in depth; but the width and length of the core boxes may be of any reasonable dimensions.



OHIO'S POSITION IN THE PRESIDENTIAL CAMPAIGN WAS SYMBOLIZED IN COKE



THE SEPARATE UNITS AFFORDED OPPORTUNITY FOR GROUPING SIMILAR PRODUCTS

Two magnets, placed horizontally against pads on the outside of the box vibrate and draw at the same time, while another magnet holds the core box firmly in place. The magnets slide on guides which insure a perfect draw. The rapping imparted by the vibrator is said to be just sufficient to loosen the box but does not decrease bulk of the core. It is built with knee pads on each side to enable two men to use one machine. The corebox is filled and rammed on the bench, rolled over and placed on the machine which simply acts as a drawing device. While one coremaker is ramming his core box the other is drawing a core already rammed.

A comprehensive line of molding machines including direct-draw, roll-over jolt machine; combination power jolt stripper squeezer, large and small type; combination jolt strippers hand operated; plain air squeezers and jolt squeezers and small roll over machines were shown at the five booths occupied by the Osborn Mfg. Co., Cleveland. Interest centered on one of the booths where a newly designed machine for making soil pipe was shown in operation. The machine is of the jolt squeezer type and the flasks are designed to take two patterns side by side.

Machines in Great Variety

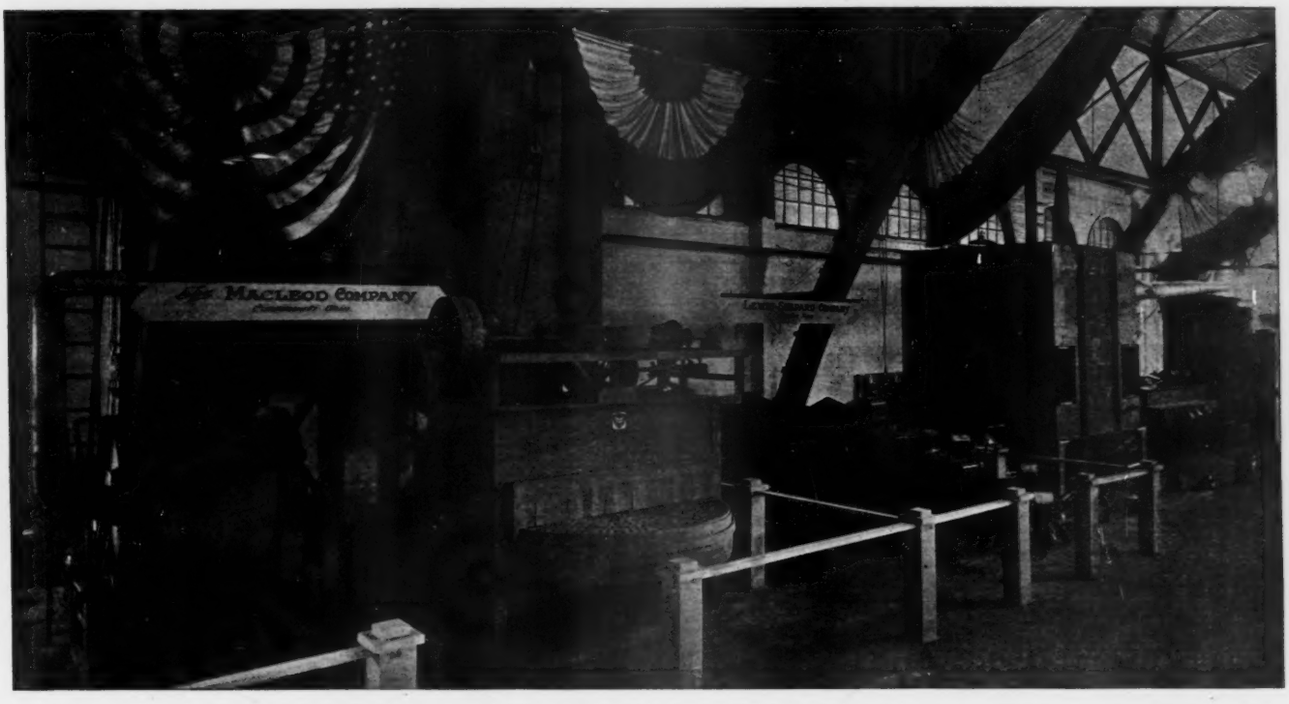
Henry E. Pridmore, Chicago, showed six different types of molding machines in operation including a 30-inch combination jolt, rollover on which was mounted a cylinder pattern. This machine was served by a chain hoist suspended from an I-beam supported on suitable stands. The Grimes Molding Machine Co., Detroit, had several machines including a jar-ram, roll over machine of 1000 pounds lifting capacity and a hand-ram rollover machine equipped with a rapidly operated pattern changing device. The exhibit of the Arcade Mfg. Co., Freeport, Ill., comprised eight different types of molding machines and also an installation showing the application of a patented pouring device. Among the seven molding machines shown by the Nicholls Co., Inc., Brooklyn, was one equipped with an electromagnetic drawing device. The Federal Malleable Co., West Allis, Wis., had three machines in operation on which were mounted unique patterns for soil pipe fittings. The Wadsworth Core Machine & Equipment Co., Akron, exhibited a coremaking machine and also a core cutting and coning machine as well as various sizes of steel cores and bottom plates. The International Molding Machine Co., Chicago, had samples of different molding machines on exhibition. The U. S. Molding Machine Co., Cleveland; The American Molding Machine Co., Terre Haute, Ind.; the Davenport Machine & Foundry Co., Davenport, Iowa; the Berkshire Mfg. Co., Cleveland; the R. J. Teetor Co., Muskegon, Mich.; the Hanna Engineering Co., Chicago; the Federal Foundry Supply Co., Cleveland also showed complete lines of molding machines. A car wheel mold stripping machine was shown at the booth of the Herman Pneumatic Machine Co., Pittsburgh.

An interesting exhibition of pattern-plate making by a patented compound was demonstrated at the booth of the Menefee Foundry Co., Inc., Fort Wayne, Ind. Exhibits at the booth included plates made of the compound which had been in use for from one to two years.

Complete lines of pneumatic foundry tools and also tools used in other lines of industry were shown by the Cleveland Pneumatic Tool Co., Cleveland; Black & Decker Mfg. Co., Baltimore; Chicago Pneumatic Tool Co., New York; Keller Pneumatic Tool Co., Chicago; George Oldham & Son Co., Baltimore; Dayton Pneumatic Tool Co., Dayton, O.; and the Independent Pneumatic Tool Co., Chicago.

The Curtis Pneumatic Machinery Co., St. Louis, displayed a double cylinder, single acting, water cooled air compressor. It was mounted on a base with electric motor and was equipped with automatic unloader. Two types of foundry cranes equipped with air hoist also were shown.

Other features of the exhibition were disk grinders made by the Gardner Machine Co., Beloit, Wis., including a special 50-inch disk grinder having an auxiliary feed attachment for supplying a constant stream of



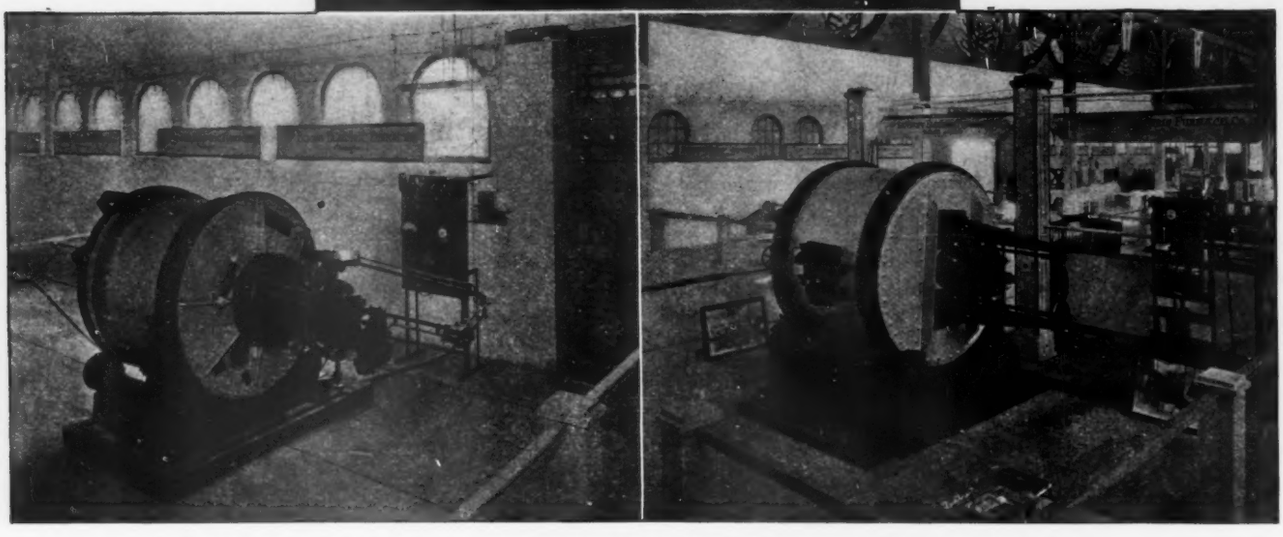
SANDBLASTING MACHINERY WAS FEATURED AND FILLED ALMOST AN ENTIRE BUILDING

work to the disk, a conical mill for pulverizing brass ashes, etc., made by the Hardinge Co., New York; a ¼-size motor driven working model of a power hammer at the booth of Beaudry & Co., Boston; and air compressors, motor and steam driven and detail accessories at the booth of the Westinghouse Traction Brake Co., Pittsburgh. Eight exhibitors made a display of different forms of transportation equipment, battery and motor trucks, trailers, self dumping and hand and power dumping bodies; wheelbarrows and double-wheeled hand trucks. These included the Clark Tructractor Co, Chicago; the Cowan Truck Co., Holyoke, Mass.; the Automatic Transportation Co., Buffalo; the Ohio Equipment Co., Cleveland; Barrett-Cravens Co., Chicago; the Lakewood Engineering Co., Cleveland; the Mercury Mfg. Co., Chicago; the Lew Shepard Co., Boston; and the Kilbourne & Jacobs Mfg. Co., Columbus.

The great number of various types of melting mediums shown at the exhibit demonstrated the trend in modern practice. Lower prices for crucibles has given an impetus to this method of melting and a number of exhibitors displayed crucible melting furnaces for nonferrous alloys. The Monarch Engineering & Mfg. Co., Baltimore, showed such a furnace equipped for burning either oil or gas, in which the air intake is so arranged that the air enters near the bottom of the steel casing and circulates around the furnace in a space between the lining and the shell. After being preheated by this operation the air enters the burner at the top of the furnace. This is said to give economy in fuel consumption. The open-flame type was represented by a 2000-pound revolving, gas or oil burning furnace. The case of the furnace is built in two horizontal sections which are connected together with a hinge and are opened when relining the furnace.

Both crucible and noncrucible brass melting furnaces also were exhibited by the Buckeye Products Co., Cincinnati. These furnaces are oil or gas burning and each furnace is equipped with a blower, thus being made an independent unit. This company also displayed a new sand riddle. The novel feature of this riddle is a perforated cast-iron plate which is moved about against the screen and thus serves to break lumps of loam or sand.

The Campbell-Hausfeld Co., Harrison, O., demonstrated an interesting feature in its burners which are designed to burn either oil or gas, or a combination of oil and gas. This latter feature is of advantage when the gas supply is low as oil then may be used to supplement the gas. Besides a number of both open-flame and crucible furnaces this firm exhibited a ladle heater for heating either one or two ladles. A gas or oil burning furnace rotated by power was exhibited by the United States Smelting Furnace Co., Belleville, Ill. This furnace tilts to pour from the end which has only a small opening. Charging is done through the end at which the flame enters after the burner is swung aside. This furnace melts 100 pounds of brass in about 30 minutes. A large assortment of burners were displayed by the Hauck Mfg. Co., Brooklyn, N. Y. A crucible furnace for brass or aluminum was equipped with a burner which operates with kerosene without an air compresosr or fan. The oil is transformed into a vapor and burns with a blue flame. Similar burners are applied under small boilers, glue pots and small core ovens.



ELECTRIC FURNACES SHOWED THE RAPID DEVELOPMENT IN THIS EQUIPMENT FOR NONFERROUS MELTING

The part electric furnaces are playing in melting steel and especially brass was indicated by the number of electric furnace companies which displayed equipment. The Booth Electric Furnace Co., Chicago, the Detroit Electric Furnace Co., Detroit, the Electric Furnace Co., Alliance, O., the Ludlum Steel Co., Watervliet, N. Y., and the Ajax Metal Co., Philadelphia, all displayed furnaces made by them and described in detailed in recent

issues of THE FOUNDRY, by H. W. Gillett.

A new model was shown by the Industrial Electric Furnace Co., Chicago. This is the Von Slegell repelling arc type furnace for melting either brass or steel. It operates directly on the power line without the use of transformers, thus saving the expense of extensive electrical equipment. The furnace exhibited has three 1-inch graphite electrodes which operate in a cylindrical graphite shell. This shell with the electrodes is lowered into the melting chamber as fast as the charge melts and subsides.

Endeavoring to convince foundrymen that counting castings by means of a scales is practical, the National Scales Co., Chicopee Falls, Mass., exhibited a number of scale counting machines. The largest of these has a capacity of 20,000 pounds. To use this style machine, one or more of the castings to be counted are placed in a receptacle which may be specially designed to suit different conditions, and the pieces to be counted are placed on the scale platform. The number of castings is then read directly on a beam.

Welding equipment was well represented by a number of firms, and besides the usual exhibit of this apparatus the Air Reduction Sales Co., New York, and the Torchweld Equipment Co., Chicago, demonstrated the practice of cutting gray iron with the gas torch, explaining the process to visitors. Davis-Bournonville Co., Jersey City, N. J., showed in their exhibit a specially designed torch for working in pockets in metal. A long neck on the tip enables it to reach in a casting for 6 inches and it is so designed that it will stay lighted when working at red heat.

Many firms of designing and building engineers occupied booths and exhibited drawings and photographs of foundry buildings. Among these were the Austin Co., Cleveland; Frank D. Chase, Inc., Chicago; H. K. Ferguson Co., Cleveland; H. M. Lane Co., Detroit; David Lupton's Sons' Co., Philadelphia, and Dwight P. Robinson & Co., Buckhill Falls, Pa. These exhibits illustrated the recent advance in the architecture of foundry buildings. The Austin Co. erected in their booth a model of their standard type foundry building, characterized by an inverted roof.

Blast-volume meters so far have not found a wide application in foundries but improvements are being made in their design which it is hoped will tend to make them more popular with the average foundryman. The Bacharach Industrial Instrument Co., Pittsburgh, exhibited a number of pressure and volume gages, among which was an instrument which was so arranged that volume or pressure readings could be taken from three cupolas on the same instrument.

Anticipating the early return of competitive conditions in the foundry industry, the miscellaneous equipment and supplies this year strongly emphasized features of economy. As has been often mentioned in the description of individual machines designed for foundry use, the saving in space, time, manpower and costs have been fundamental considerations in bringing forth many of the devices of the past few years. Simplicity marks recent innovations which have been introduced in handling and conveying machinery. Grinding, tumbling, and sandblast equipment, though showing few radical changes has been improved in many small details which make for efficiency and low cost of operation with long service. Sand mixing and revivifying apparatus, and various appurtenances for reclaiming foundry refuse point the way to conservation, the need for which has been inspired by recent high material costs and now is about to be impressed more strongly by the need for close figuring on production expenses.

The Columbus show excelled all previous exhibitions in the display of operating sandblast and allied equipment. The Pangborn Co., Hagerstown, Md., had an operating exhibit, where castings were cleaned. No radically different apparatus was noted, although two new table type installations, one of the gravity and the other pressure type were shown. The Standard Equipment Co., New Haven, Conn., displayed three sizes of its radial sandblast barrels, and in addition had a cinder mill which was in operation. The Hoevel Mfg. Corp., Jersey City, N. J., had a number of machines, and in addition a complete sandblast room, of the knock-down all metal type. This is designed to be erected over a return hopper. A perforated floor permits the used sand to drop through into the hopper from which it is carried by a screw feed to a bin for further use. Ventilation is provided through a suction fan overhead, which draws air from hooded vents around the walls. S. Obermayer Co., Chicago, recently has taken over the sale of the tumbling barrel manufactured by the Ideal Machinery Co., Cincinnati, and one of the company's

NUMEROUS EXHIBITS DEMONSTRATED THE APPLICATION OF TRUCKS AND TRAILERS TO INTERPLANT TRANSPORTATION

THE MANUFACTURERS OF PIG IRON AND COKE DISPLAYED THEIR PRODUCTS ATTRACTIVELY AND INDICATED THE SOURCES OF THEIR SUPPLIES

machines was shown. This is designed for use with small castings. The dust is exhausted through the discharge end of the barrel through a door which may be drawn back upon a hand operated screw shaft. A central chain belt connected to a motor which is unit with the machine turns the barrel and imparts the tumbling effect. A novel feature is introduced in the elevating skip, similar to that which is employed upon some types of sand mixers. This is driven from the same main motor, and provides a ready means for dumping the entire charge of castings into the barrel at one time. The American Foundry Equipment Co. which recently was consolidated and became a part of the Whiting Corp., Harvey, Ill., displayed sandblast installations of the various classes, and further a cloth-screen dust arrester for use with this equipment.

Milwaukee Made Famous

Milwaukee was prominently represented by two exhibits of machinery for reclaiming metal from waste materials. The Magnetic Mfg. Co., of that city, illustrated two types of magnetic separators for iron and steel foundries. The Dings Magnetic Separator Co. had three machines in operation. One is a type which has been found valuable in various foundries making castings from ferrous metals. It is in use in one malleable foundry for reclaiming iron from malleable slag after the latter material has been broken by passing it through a hammer mill. Another type shown is designed for handling finer particles and is used in aluminum and brass foundries for reclaiming small particles of iron filings or borings. A cross belt is employed to remove the iron from the magnetic belt after the nonferrous material has been deposited. This type machine also is used by abrasive manufacturers in removing ferrosilicon from the alumina or other basic materials used.

Much attention has been given to core oven equipment in the past year. Economy in fuel consumption and improvement in ventilating are the principle advances shown. Young Brothers Co., Detroit, had on display a two-compartment rack type oven, in which gas is used in one side and electric resistance units furnish the heat in the other. Special fans connecting to ample exhaust fans serve to remove all fumes from the oven without permitting them to escape into the foundry. W. W. Sly Mfg. Co., Cleveland, had a two-section oven, each side of which is provided with five drawers. A cantilever beam extending out in front of each section serves to support a rigid shaft attached beneath a trolley which operates upon this beam. The shaft is provided with a number of catches which engage slots in the various drawers as desired. In this manner no post or other obstruction is necessary in front of the oven to provide means for pulling the drawers forward, and the trolley supported shaft serves to hold up the front of the drawer as it is drawn outward.

Developments in lifting and conveying equipment were demonstrated by photographs, models and full size installations. Chesapeake Iron Works, Baltimore, made use of all three means for presenting its products, as did also the Hayward Co., New York, Link-Belt Co., Chicago, and the Louden Machinery Co., Fairfield, Iowa.

An interesting exhibit, showing the evolution effected in cupola blowing was shown by the P. H. & F. M. Roots, Connersville, Ind., who had in their space the first blower built by the firm together with the present

SEVERAL FULL SIZE CRANES WERE SHOWN IN OPERATION

type of product. The Spencer Turbine Co., Hartford, Conn., had a turbo-compressor direct connected to a 30 horsepower Westinghouse motor. The equipment was designed by the company for furnishing cupola blast.

Practical operating units provided by Ingersoll-Rand Co., New York, and Sullivan Machinery Co., Chicago, were utilized to provide compressed air for the air-operated exhibits in two of the buildings. These were both motor driven.

McLain's System, Inc., Milwaukee, had a striking exhibit of semisteel products. A recent application of Mr. McLain's investigations was shown in a number of hammers, hatchets and other small hardware specialties made from a cupola melted product containing from 15 to 50 per cent steel. These had been annealed, and samples of the metal are stated to have developed from 55,000 to 70,000 pounds per square inch tensile strength.

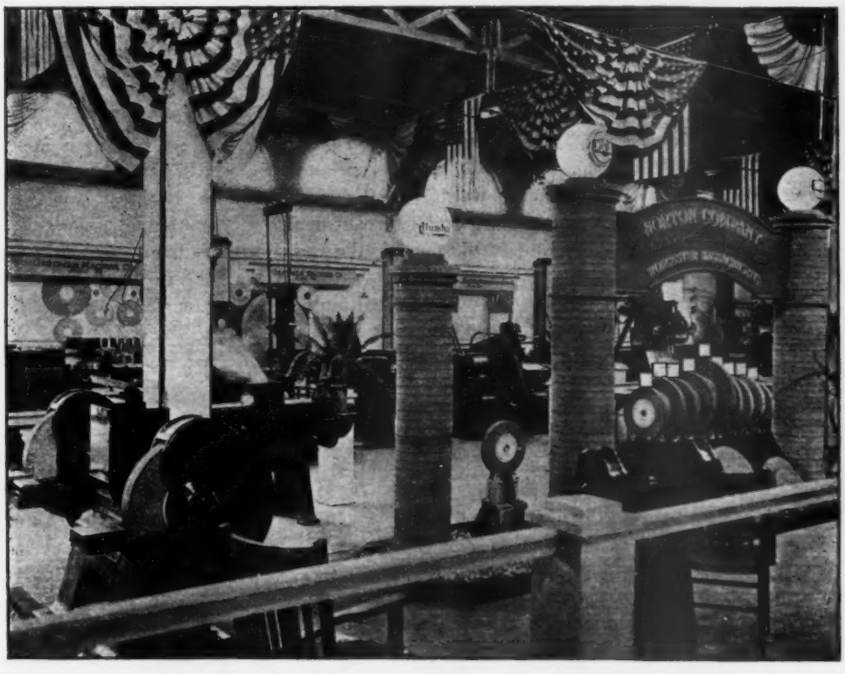
WORKING EXHIBITS WERE IN OPERATION ON COLUMBUS MADE CASTINGS

Foreign interest in the exhibition was evident and not alone through the number of visitors from abroad who were present. The British Aluminum Co., Ltd., had a space in which were shown samples of the bauxite ore from which aluminum is produced and an interesting variety of products of aluminum, ranging from the ingots and pellet forms of the metal for ladle additions to the sections of the rolled or extruded material in finished forms.

The Geist Mfg. Co., Atlantic City, N. J., had a flat bed, gas-fired preheater upon which castings are heated to the required temperature and if desired are welded without being removed. This apparatus was shown in operation upon specimens furnished by local foundrymen.

The trend in flask design was evidenced by a number of extensive exhibits. The Sterling Wheelbarrow Co., Milwaukee, had an attractively arranged display of rolled steel flasks for varied uses, together with foundry wheelbarrows, tote boxes, trucks and sundries.

Although the most extensive displays of machine shop equipment were made by machinery dealers, a number of manufacturers exhibited their products and showed by actual demonstration many improved features in the design and construction of their tools. The various exhibits reflected a tendency toward the elimination of certain shafts, gears and pulleys in driving mechanism, thus permitting a greater portion of the motor horsepower to be delivered to the spindle. In several machines, the elevating screw which controls the vertical movement of the work table, is driven from the top instead of from the bottom, as in the conventional design of the past. An improvement in the method of chucking is indicated by the number of machines which are equipped to hold work by means of magnets, air or chuck jaws controlled by planetary gears.



EVEN THE MOST COMMONPLACE MATERIALS WERE ATTRACTIVELY ARRANGED

A novel chucking device was shown in connection with the exhibit of the Warner & Swasey Co., Cleveland. A universal, hollow hexagon turret lathe was demonstrated on a two-step gear blank job and a double friction, back geared turret lathe was shown turning out cone gears. These machines were equipped with air chucks manufactured by the Frontier Chuck & Tool Co., Buffalo. Air at from 30 to 90 pounds pressure is admitted to a cylinder, forcing a wedge pin attached to a piston against a lever which in turn operates the chuck jaw. When the air is released the jaws are returned to their normal position by the pressure of a coil spring. The chucks fit any standard arbor and are self-contained except for the small air line connecting the chuck to the supply pipe. The Thomas Elevator Co., Chicago, dis-

played a wrenchless chuck in which a planetary gear is employed.

Perhaps the most revolutionary machine tool shown at the convention was the new slotting machine of the milling type manufactured by the Racine Tool & Machine Co., Racine, Wis. In effect, this tool is an interior milling machine with a cutter somewhat resembling a broach. The cutter is held in a vertical position and is given a reciprocating motion by a crank disk operating a connecting rod. The length of the stroke is 7 inches. The feeding arrangement is such that the proper pressure on the tool is maintained throughout each stroke. The machine is designed for slotting, broaching or keyseating interior openings.

Among the five grinding machines shown by the Heald Machine Co., Worcester, Mass., was a rotary surface grinder equipped with a horizontal magnetic chuck. A rectangular magnetic chuck, two internal grinders and a cylinder grinding machine were demonstrated by this company. Grinding and polishing machinery was exhibited by the St. Louis Machine Tool Co., St. Louis.

Metal sawing machinery attracted much attention, probably because of the rapid strides made in the development of this type of equipment during the past few years. E. C. Atkins & Co., Indianapolis, exhibited a new hack saw machine. The Metal Saw & Machine Co., Inc., Springfield, Mass., operated metal cutting band saws and the Black Diamond Saw & Machine Works, Natick, Mass., exhibited band and circular saw filing machines.

The manufacturers of circular saws emphasized the merits of various types of inserted tooth saws. These saws were demonstrated on machines built by the Higley Machine Co., New York, by the Simonds Mfg. Co., Fitchburg, Mass., and Henry Disston & Sons, Philadelphia.

Complete lines of woodworking and patternmaking machinery were shown by the American Woodworking Machinery Co., Rochester, N. Y., and the Oliver Machinery Co., Grand Rapids, Mich. This year's exhibits of these companies again reflected the tendency toward direct or closely connected electric motor drive for practically all woodworking tools. The simplicity of direct motor drives was particularly emphasized in the display of bench planers, jointers and saws exhibited by J. D. Wallace & Co., Chicago. Patternmakers' disk grinders were on display at the booths of the Charles H. Besly Co., Chicago, and a revolving knife wood trimmer was shown by A. E. Bauer & Son, Chicago.

Furnace Men Learn Facts About Refractories

Opportunity was afforded by the foundrymen's convention to bring together two component lines of manufacture upon which is vitally dependent the successful use of electric furnaces in melting both ferrous and nonferrous metals. Many of the largest builders of electric furnaces were exhibitors at the foundry show and in the same building with them were producers and manufacturers of refractory materials. With a view to obtaining an interchange of ideas and profiting by the experience of practical melters who were in attendance at the technical sessions of the foundrymen's society, the Electric Furnace Association called a meeting on Wednesday afternoon, Oct. 6, at the Ohio State University. President Acheson Smith, Acheson Graphite Co., Niagara Falls, N. Y., introduced a number of international authorities who presented papers on natural and artificial materials for lining electric furnaces.

EDITOR'S NOTE

The third article on judging sands for foundry use, by Henry B. Hanley and Herbert R. Simonds, has been omitted from this issue, due to the quantity of material arising from the American Foundrymen's convention in Columbus. The third and fourth articles completing the series will be presented Nov. 1 and Nov. 15.

R. M. Howe, Mellen Institute, Pittsburgh, who is in charge of research for the Refractories Manufacturers' association outlined the physical and chemical properties of the nine materials which commonly are used. He pointed out that although some of these materials were resistant to melting up to a maximum of 2500 degrees Cent., none of them should be used in furnaces which were heated above 1650 degrees as at about 1700 degrees all of them passed through a state where some of the constituents showed properties of viscosity and failed under pressure.

Dr. M. L. Hartman, Carborundum Co., Niagara Falls, N. Y., recommended an inner refractory lining backed by an outer insulating surface which would protect the lining of the furnace and retain the heat. He stated that high heat resistance is of primary importance in roofing materials, both in steel and nonferrous melting.

R. T. Stull in charge of the government research laboratory of ceramics at Ohio State University explained the chemical reactions which take place when different natural and synthetic refractories are heated. He stated that sillmanite which occurs in only a limited amount in natural deposits should make a satisfactory refractory. This material may be obtained from manufacturers. It commonly is prepared by mixing and grinding fireclay and bauxite together. This material then is calcined, crushed, bonded, molded, pressed, dried, and burned into bricks at a temperature of about 2750 degrees Fahr. Spinel, which is prepared by mixing magnesium oxide and ores containing alumina, similarly is useful. Zirconia, which is found in natural state, notably in mines in Florida was said to have great possibilities. The author recommends the use of electric furnaces in preparing artificial refractories and tunnel type kilns for its final preparation in brick form.

H. F. Staley, bureau of mines, Washington outlined the various methods of preparing refractories and the merits and limitations of each. The use of thin coatings of highly refractory materials backed by less heat resistant materials was stated to result only in lowering the effective resistance of the latter.

The main problem confronting refractory manufacturers was stated to be a satisfactory material for steel melting furnaces. The ideal properties of lining materials were defined as: Resistance to sudden changes of temperature; constancy of volume over wide ranges; resistance to slag corrosion; resistance to corrosion by fumes; and durability under abrasive action. Thin washes of tough refractory materials were recommended by a number of speakers as a means to prevent cracking and eating away of the lining at the joints. Materials used in laying up linings are vitally important. A thin surface coating of silicious or similar material is said to protect linings from fumes which develop both in steel and nonferrous melting. Dr. Howe recommended the mixture of finely ground bats or material similar to that used in the lining with any surface wash which is used.

White Metal Alloy

An alloy that may find extensive application wherever a white metal is required is composed of zinc, 88 per cent; copper, 9.75 per cent; aluminum, 1.25 per cent and tin, 1 per cent. The copper should be melted and the tin and aluminum added; then 12 pounds of zinc are added which forms a hardener. This is cast into ingots and remelted with the balance of the zinc to form the alloy.

Malleable Made by Triplex Process

The Patented Process Involves the Use of the Cupola, Side-Blow Converter and the Electric Furnace—Details of Operation and Metallurgical Reactions Are Explained

BY H. A. SCHWARTZ

SOME eight or ten years ago the National Malleable Castings Co., became interested in the use of electric furnaces. Naturally the original field of investigation was in the manufacture of steel castings, and the work was conducted at the Sharon plant of the company.

Preliminary experiments at Sharon having demonstrated the probable usefulness of the electric furnace in the metallurgy of malleable cast iron, an experimental plant was later installed at the company's Grant works at Chicago for the further development of this application on a semimanufacturing scale.

A very considerable amount of development work was required to overcome various commercial and metallurgical difficulties encountered, but a process soon was developed for supplementing the electric furnace with various auxiliaries and producing a high grade product under commercial conditions. The process as covered by various patents of its inventor, W. G. Kranz, vice president of manufacture of the National company, has now been in commercial operation for some years and very large tonnages of electric furnace malleable have been made and sold. Under ordinary conditions the Grant works makes only electric furnace malleable, although the old air furnace equipment still is available in case of emergency. The company's new Woodhill road plant in Cleveland is equipped available procedure is the converter furnace.

On account of the commercial importance of the tonnages of malleable iron now produced by this method it may not be inopportune to place on record a brief description of the metallurgical principles upon which the operation of the Kranz triplex process depends.

Use Cupola, Converter and Furnace

It is well known that the electric furnace finds its greatest advantages under conditions where it is desired to melt the product with as little change of chemical composition by oxidation as possible. However, this result is accomplished at a considerable expense for fuel in the form of electric power. Where the economical melting of the material is of prime importance nothing so far discovered exceeds the cupola in convenience and economy for melting iron.

The cupola product, however, is somewhat erratic as to chemical composition and more particularly is nearly always relatively high in carbon content. For the oxidation of carbon and, by inference, of silicon and manganese also, the most economical available procedure is the converter process.

The cupola and the side-blow converter therefore are admirably adapted to work in conjunction with the electric furnace and to supplement its shortcomings. The cupola furnishes cheaply a supply of molten iron of only approximately controlled chemical composition and of a higher carbon content than is desired in the product. The side-blow converter readily decarbonizes iron converting it into molten steel. The electric furnace can very efficiently take as its charge a mixture of molten cupola iron and molten converter steel and finish this charge by additional heating and by the elimination of oxygen and sulphur. This combination of operations constitutes in general the triplex process. The equipment for the commercial operation of the process consists of a

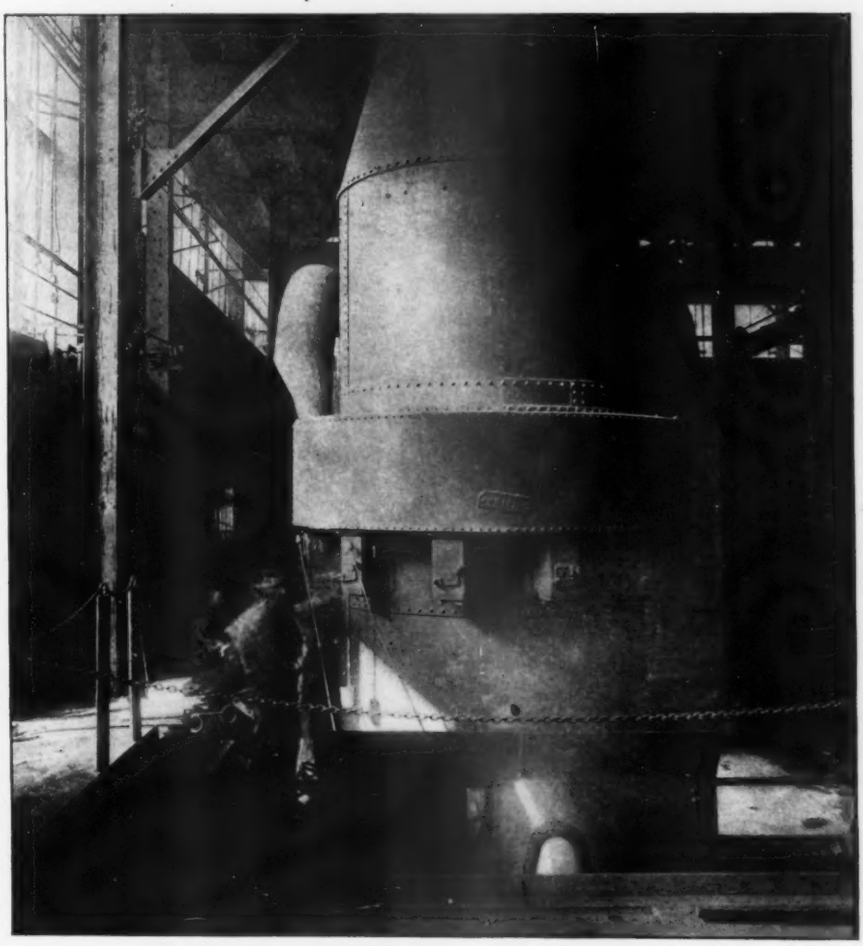


FIG. 1—IN THE FIRST STEP OF THE KRANZ TRIPLEX PROCESS THE CUPOLA DELIVERS THE MOLTEN IRON INTO A LADLE RESTING ON THE BOTTOM OF A PIT BELOW THE FLOOR LEVEL

From a paper presented at the convention of the American Foundrymen's association Oct. 4-8 in Columbus, O. The author, H. A. Schwartz, is connected with the National Malleable Castings Co., Cleveland.

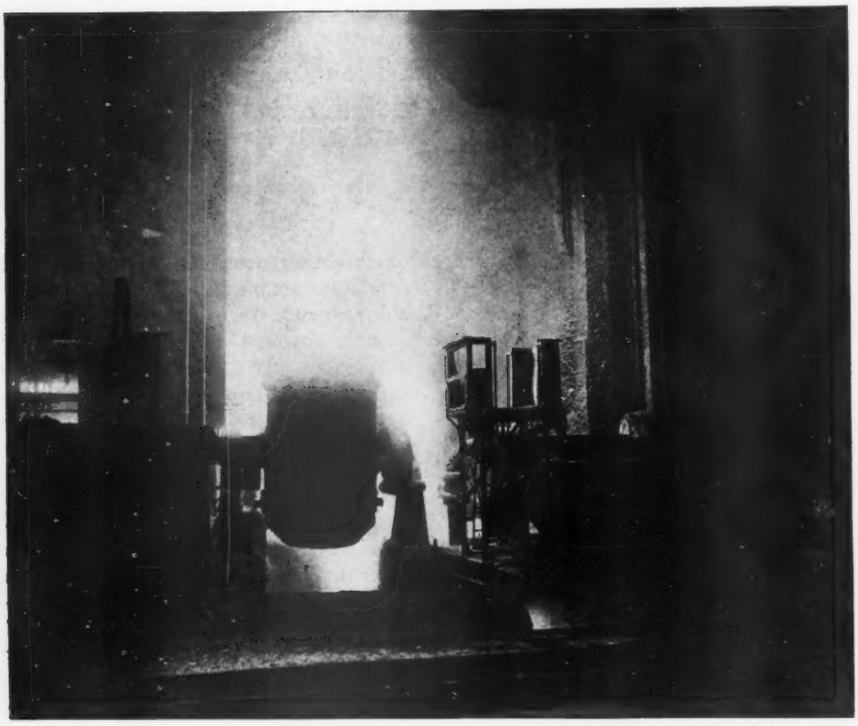


FIG. 2—IN THE SECOND STEP OF THE PROCESS PART OF THE METAL IS BLOWN IN A 2-TON SIDE BLOW CONVERTER WHICH COMPLETELY REMOVES THE CARBON

cupola of sufficient size to supply continuously molten iron at the rate required by the electric furnaces. Working in conjunction with the cupola is a side-blow converter of such capacity as to be capable of decarbonizing a sufficient proportion of the cupola output to reduce the carbon content of the mixture of cupola metal and the metal from the converter to the desired figure. These two units together serve the electric furnace.

In both plants the electric furnaces are of the heroult type operated at approximately 100 volts on 3-phase alternating current. In addition to the metallurgical units referred to, it must be understood that suitable cranes, electric regulators, and other auxiliary equipment are also required.

A clearer understanding of the metallurgical fundamentals of the process probably will be obtained by a step-by-step discussion of the functions and operations of the three separate stages in the melting operation. Let us assume to begin with that it is desired to produce as the final product of the melting operation molten iron analyzing as follows: Carbon, 2.50; silicon, 0.75; manganese, 0.25; sulphur, 0.05, and phosphorus, not over 0.20 per cent.

The first step in the process is to determine a suitable cupola charge to furnish molten cupola metal of a proper composition to serve as the starting point of the entire process.

The great latitude in control of the melting process under consideration permits of considerable variation in the melting stock fed to the cupola. The only requirement is that the mixture shall not have more phosphorus than is desired in the resulting product and that the silicon content shall be such as not to be higher in the molten metal fed to the electric furnace than in the final product while remaining high enough to permit of satisfactory cupola and converter operations.

The carbon and sulphur content is immaterial. As a matter of fact, no consideration need be given to the manganese in practice, although too high a manganese value in the cupola metal would be a disadvantage. In actual operation these requirements are met by limiting the cupola stock to materials, none of which are higher in phosphorus than the resulting malleable to be made.

Generally the melting material is sprue, malleable scrap, steel scrap and high silicon pig iron in such relative proportions as to give to the mix as charged an average silicon content of 1 per cent or a very little over. This silicon content in the mix produces a molten metal of a silicon content about 0.85 per cent, which is quite suitable to the execution of the further steps in the process.

As already stated the manganese, carbon and sulphur content of the mix is unimportant, although in mixes made of the material mentioned the manganese will be about 0.25 to 0.30 as charged and the carbon about 2.50 to 2.70 per cent.

During the melting operation the metal always loses manganese and silicon and gains sulphur. It may gain or lose carbon depending upon the carbon content of the original charge and the melting condition in the cupola. As a matter of fact the carbon content of the molten iron is but little affected by the carbon content of the material charge, and greatly affected by the temperature and

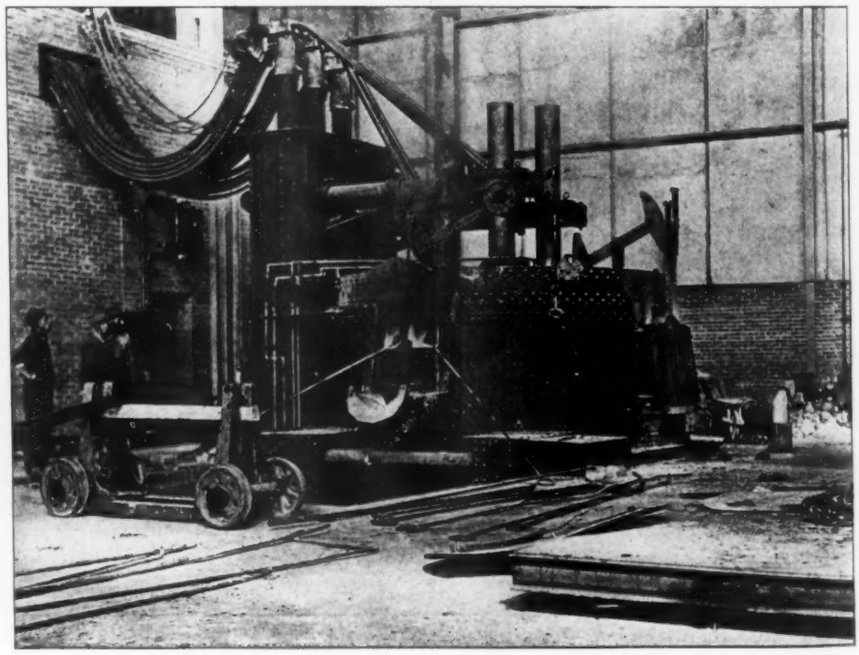


FIG. 3—THE HIGH CARBON METAL DIRECT FROM THE CUPOLA AND THE CARBONLESS METAL FROM THE CONVERTER ARE POURED INTO THE ELECTRIC FURNACE WHERE THE SULPHUR IS REDUCED TO ANY PREDETERMINED POINT

depth of the incandescent bed of coke over which the iron passes after it is melted.

It has been found by experience that under the operating conditions usually existing the carbon content of the cupola metal ranges from about 2.75 to about 3.25 and averages slightly over 3 per cent. A mix such as that quoted above, therefore, will result in molten metal having a chemical composition of carbon, about 3.00; silicon, 0.85; manganese, 0.14; sulphur, 0.13; and phosphorus under 0.20 per cent. We have, therefore, a molten metal too high in carbon, silicon and sulphur, too low in manganese and of the correct phosphorus content for the final composition desired. Then the first step is the removal of the carbon. The side-blow converter is very readily operated under conditions which result in a product practically free from carbon, silicon and manganese. The carbon content in the molten metal entering the electric furnace can be controlled by merely taking the right relative amount of cupola and converter metal.

Carbon Content Regulated.

In the case under consideration we desire to produce a final product having five-sixths of the carbon content of the cupola metal. This means that one-sixth of the metal entering the electric furnace must be completely decarbonized. In other words, for a 6-ton heat 1 ton of converter metal and 5 tons of cupola metal will be required. Therefore, for each heat an amount of cupola metal which after conversion will leave 1 ton of steel is introduced into the bessemer converter and practically completely decarbonized.

The molten steel is then mixed in a ladle with 5 tons of cupola metal and the resulting mixture poured into the electric furnace. The resulting mixture by calculation should have the chemical composition: Carbon, 2.50 per cent; silicon, 0.71 per cent; manganese, 0.11 per cent; sulphur, 0.13 per cent; and phosphorus, under 0.20 per cent.

This composition is correct for carbon and phosphorus. The silicon and manganese are too low and the sulphur is too high. At this stage of the process a sample is taken for analysis and the further operation conducted in accordance with the result of that analysis.

The laboratory makes determinations of carbon, silicon, manganese and phosphorus. It is not intended that the first and last of these elements should require any further changes. Sulphur determinations are not made since this element will be further acted upon during the progress of the electric operation.

The furnace itself is basic lined and the atmosphere very nearly neutral. Of its own accord, therefore, it would make little or no change in the chemical composition of the iron contained in it. For the purpose of removing oxygen and sulphur a slag is formed upon the surface of the metal by throwing in lime, fluor spar and crushed coke. Calcium carbide is formed in the slag by the reaction of the coke and lime.

As long as any oxygen or metallic oxides remain in the metal the calcium carbide is oxidized as rapidly as formed at the expense of the oxygen of the bath. When this is completely gone, a reaction between the lime of the slag and the sulphur of the metal begins and goes on during the progress of the heat.

The degree of desulphurization obtained depends upon the time and temperature. It has been possible to reduce the sulphur to abnormally low amounts; sometimes down to 0.01 per cent. This has no commercial advantage and some disadvantages, and in practice the attempt is made to stop the desulphurization at approximately 0.04 per cent. While the desulphurizing has been going on the laboratory report has come in and the melter can determine by calculation how much ferromanganese and ferrosilicon must be added to the heat to obtain the desired final analyses.

FIG. 4—TRANSFER MOTOR TRUCK AND TRAILER USED FOR CONVEYING THE LADLES OF METAL FROM THE CUPOLA TO THE CONVERTER AND THE ELECTRIC FURNACE

Making Corrections in Ladle

These alloys are added either to the furnace or to the ladle. The manganese always comes out low enough in the preliminary analyses to require an addition. Occasionally the silicon is higher than the desired amount, and if the error is sufficient to warrant it, the silicon can be oxidized by the addition of a limited amount of iron ore.

(*Concluded on page* 825)

European Equipment Progressive

Although the War Exerted a Depressing Effect Upon the New Molding Machines, It Served to Develop to High Efficiency Those Already in Service— Excellence is Shown in Smaller Types

BY H. COLE ESTEP

MOST of the molding-machine manufacturers of Europe are found in Great Britain, France, and Germany, although builders also are located in Scandinavia and Italy. The field, however, is dominated by the three countries first mentioned and within their borders may be found examples of all of the types of molding machines in use in Europe. In addition to the simplest forms of plain squeezer and stripping-plate machines, special molding machines of various kinds

As in other countries, European molding machines may all be divided into four fundamental classes — squeezer, stripping-plate, roll-over, and jar-ramming, various combinations of these functions being worked out in individual machines. But although the fundamental principles are the same, there are wide differences in the methods of applying these principles, as between machines built in the United States and

worthy of study by American foundrymen. It is the purpose of the author to present the subject almost entirely from the descriptive standpoint and no effort has been made to write a critical essay. Discussion of the relative merits and advantages of American and foreign machines also has been avoided for obvious reasons, chief among which is the fact that operating conditions and the labor factor are so divergent on the opposite sides of the Atlantic, that it

FIG. 1—BRITISH HAND SQUEEZER MACHINE FOR SMALL CASTINGS

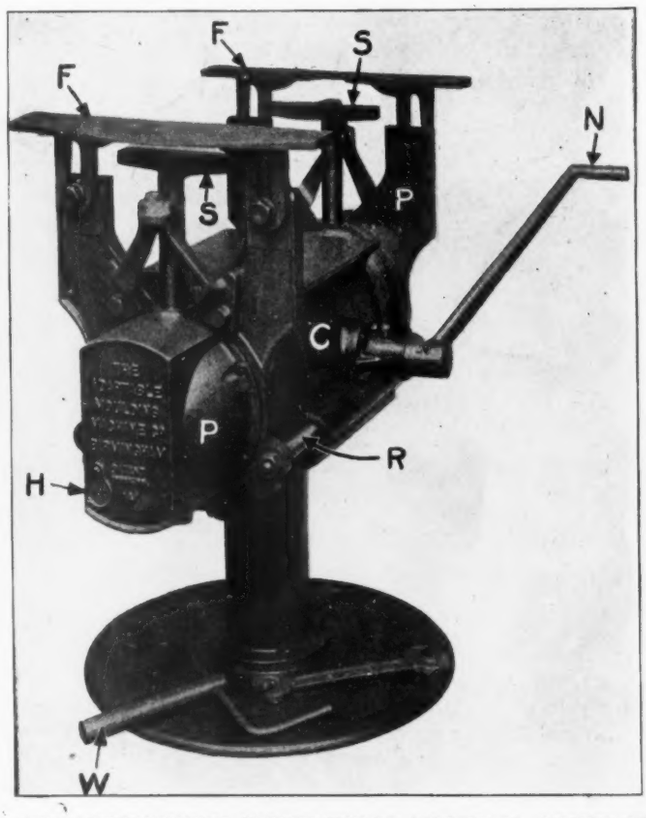


FIG. 2—THIS PATTERN DRAWING MACHINE MAY BE ADJUSTED TO A RANGE OF FLASK SIZES

these types includes plain jar-ramming machines; combination jar-ramming and roll-over machines; turn-over machines of the trunnion type with pattern-drawing and mold conveying attachments; pneumantic and hydraulic squeezer machines with and without rollover attachment; electric jar-ramming and squeezer machines; and most European countries. Many European molding machines, therefore, have a decidedly strange appearance in American eyes.

It is the purpose of this paper to describe and illustrate some of the principal types and styles of British, French and German molding machines, in order to try and bring to the western world a clearer idea of their design and methods of operation than has prevailed heretofore. Many of these machines present features and advantages which are well

would be difficult if not impossible to make criticisms fairly. Readers should perhaps be cautioned, when studying types of machines to be presented, to bear in mind that they have not been designed for American foundries, although many of them contain features which might be applied, with some modifications, to American practice. Finally, it should not be assumed that this paper is in any way complete or comprehensive. Lack of time, and the writer's limited experience in Europe, have pre-

A paper presented at the annual meeting of the American Foundrymen's association held at Columbus, O., Oct. 5-8. The author, H. Cole Estep, is European manager of THE FOUNDRY, London.

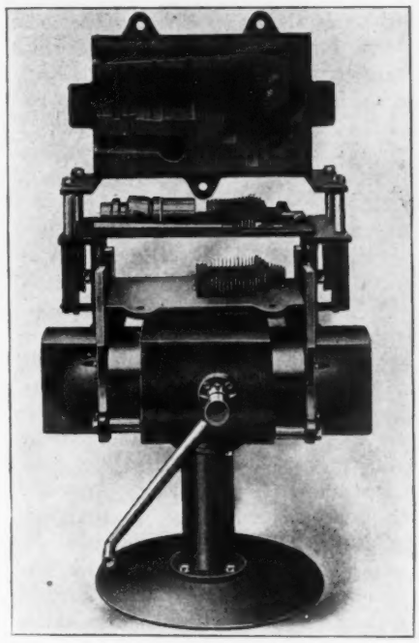


FIG. 3—DOUBLE-DRAW ADAPTABLE MACHINE FITTED WITH AIR-COOLED CYLINDER

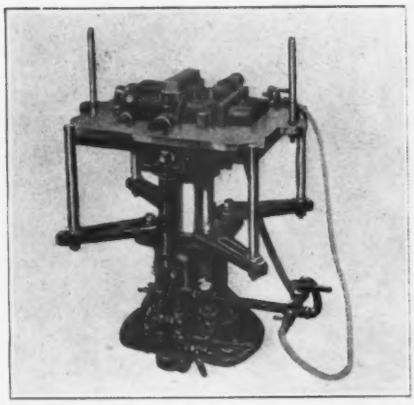


FIG. 4—SMALL BRITISH JAR-RAMMING MACHINE, FITTED WITH ADJUSTABLE STEEL RODS FOR HOLDING FLASK WHILE TABLE IS LOWERED TO DRAW PATTERN

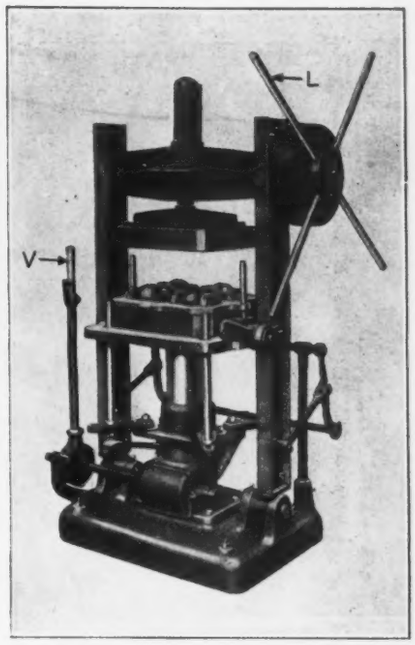


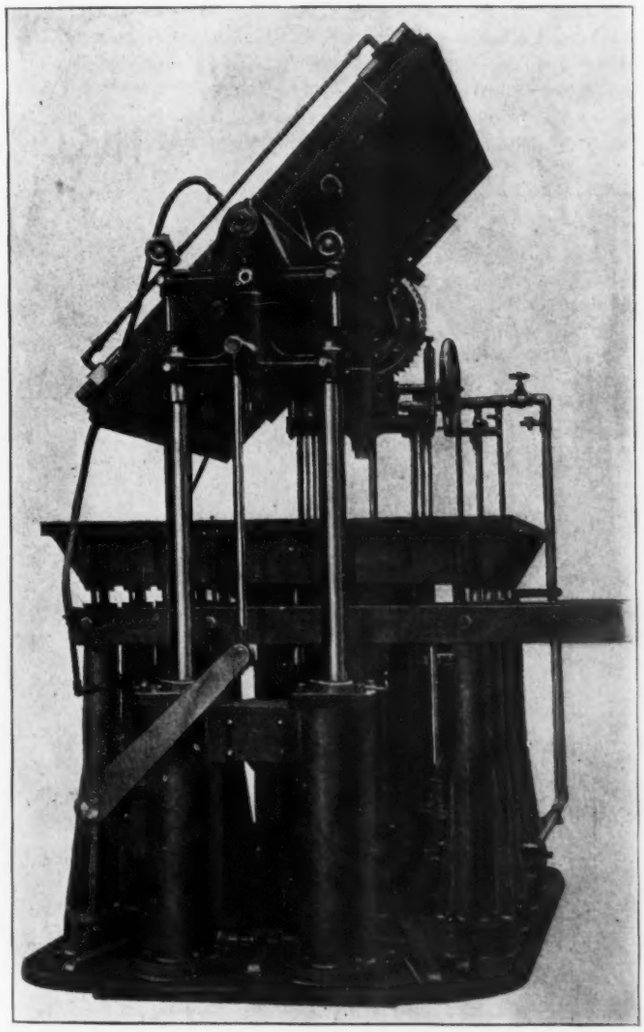
FIG. 5—GEARED-HEAD HAND SQUEEZER MACHINE

vented anything in the nature of an exhaustive study. The paper is offered merely as a series of descriptive notes on European molding machines, showing perhaps to some degree the progress which was made in design and construction during the war period.

As a matter of fact the war did little for the development of the molding machine in Europe. Everyone concerned was too closely tied down by insistent demands for production to have any energy to spare for expert mental work or new developments. Most progress made during the war was in adapting existing machines to cast-shell and grenade production. However, in the years since the armistice, a number of new types of machines have been brought out, especially in Great Britain.

Great Britain is the leading producer of molding machines in postwar Europe. Her machines are characterized by inventive genius and independence of precedent; their development has been stimulated by the growth of the motor-car industry in the United Kingdom and by the great demands of the British shipbuilding industry for quantities of heavy iron and steel castings.

A large number of plain squeezer machines, with the conventional swing-back head, are made in England. A typical



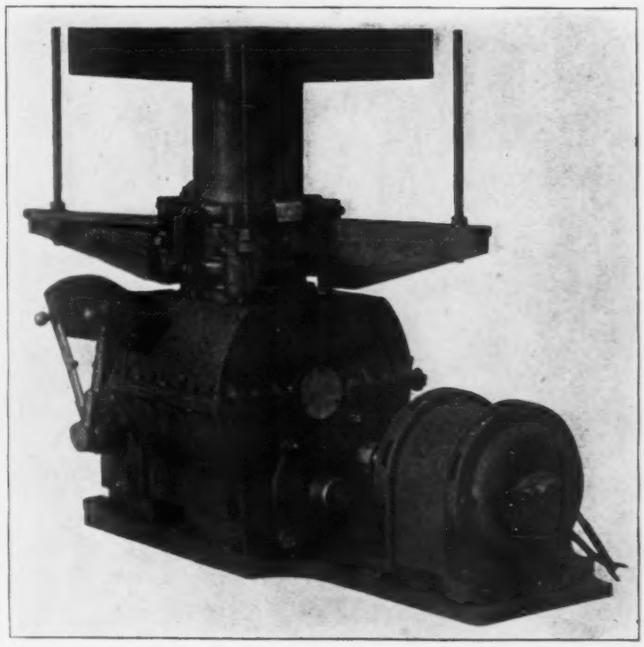


FIG. 6—A LARGE BRITISH JAR-RAMMING MACHINE WITH A CAPACITY OF 10 TONS FIG. 7—A COMBINATION ELECTRIC AND PNEUMATIC JAR-RAMMING MACHINE RECENTLY PATENTED IN ENGLAND

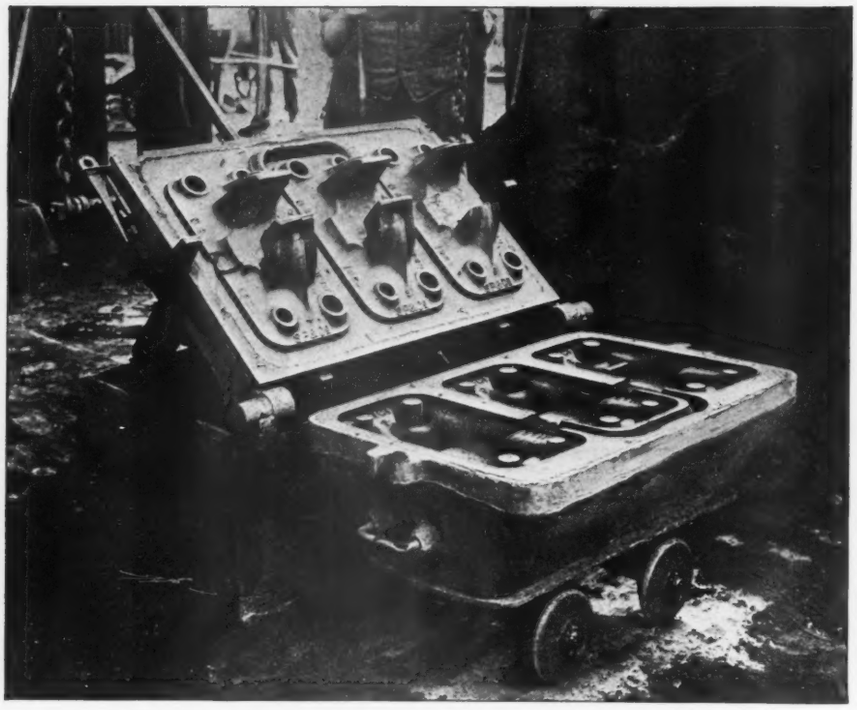


FIG. 8—A SPECIAL BRITISH MACHINE FOR MOLDING RAIL CHAIRS

machine of this character is shown in Fig. 1. It has a hand-lever squeeze by means of which a pressure of about one ton can be applied to the mold. No detailed description of this device is necessary.

Owing to the fact that even in the largest British foundries operating on a quantity production basis the multiplicity of designs makes frequent changes of pattern and flask equipment necessary, a widespread demand has grown up for an adjustable molding machine which can be readily adapted to a large number of different sizes of flasks. To meet this demand, the machine shown in Fig. 2 has been produced by the Adaptable Moulding Machine Co., Birmingham, England. It is one of the most widely used European machines in the small-castings field. It is hand operated and is designed for hand ramming, but is equipped with a pattern-drawing, stripping-plate and turn-over attachment. The construction and operation of this machine is shown in Fig. 2. The main column supports a cylinder *C* in which the pattern-drawing and flask adjusting mechanism is housed. The two end pieces *B*, which carry the flask rests *F* and pattern-plate stools *S*, are made to fit into the main cylinder *C*, and to slide back and forth, steadied by the guide rods *R*. A lead screw which may be turned by the socket-wrench *W* operating through the hole *H*, is located in the interior of the machine. It is so connected to the two sliding heads *P* that when the wrench is applied, the heads and their accompanying paraphernalia may be moved together or drawn apart in unison, guided by the rods *R*. In this way the machine may be instantly and accurately adjusted to fit flasks between 12 and 20 inches in width. A larger size machine is adjustable for flasks between 18 and 26 inches. The machines have a 6-inch draw. Turnover and 12-inch lift attachments also are provided. Flasks over 30 inches in length can be handled.

The pattern-drawing mechanism is worked by the handle *N* which is connected to the drawing stools *S* through gearing working on splined shafts. Therefore in adjusting the machine to flasks of different widths, the pattern-drawing mechanism is unaffected. The working parts are totally enclosed and run in lubricants. This is done to insure a smooth and accurate draw. These

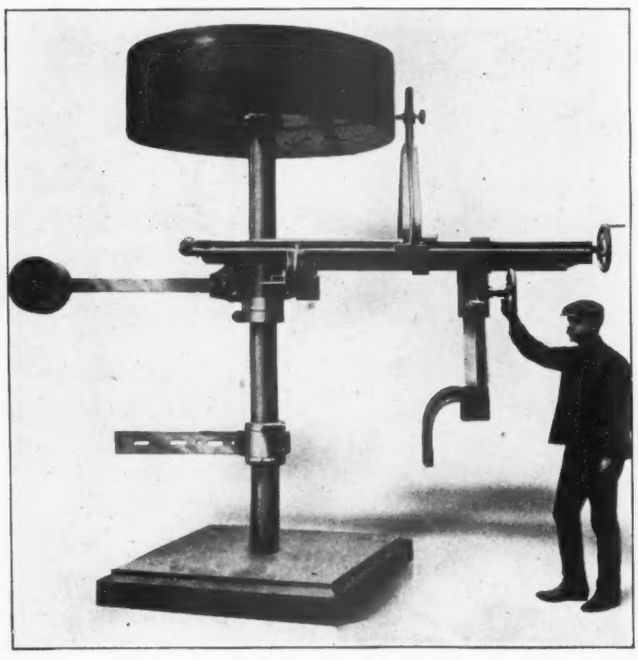


FIG. 9—A BRITISH GEAR-MOLDING MACHINE WITH DIVIDING HEAD

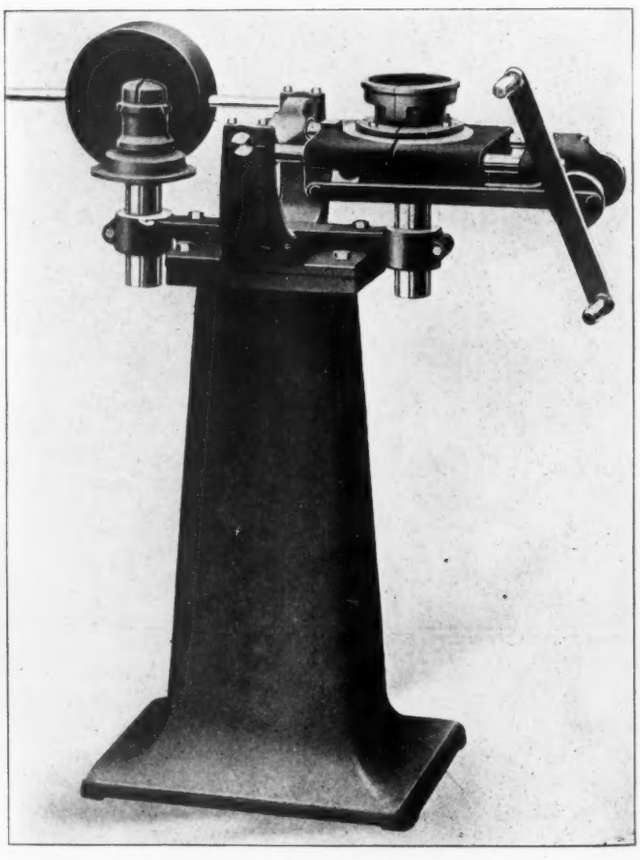


FIG. 10—A MACHINE FOR MAKING PISTON CORES

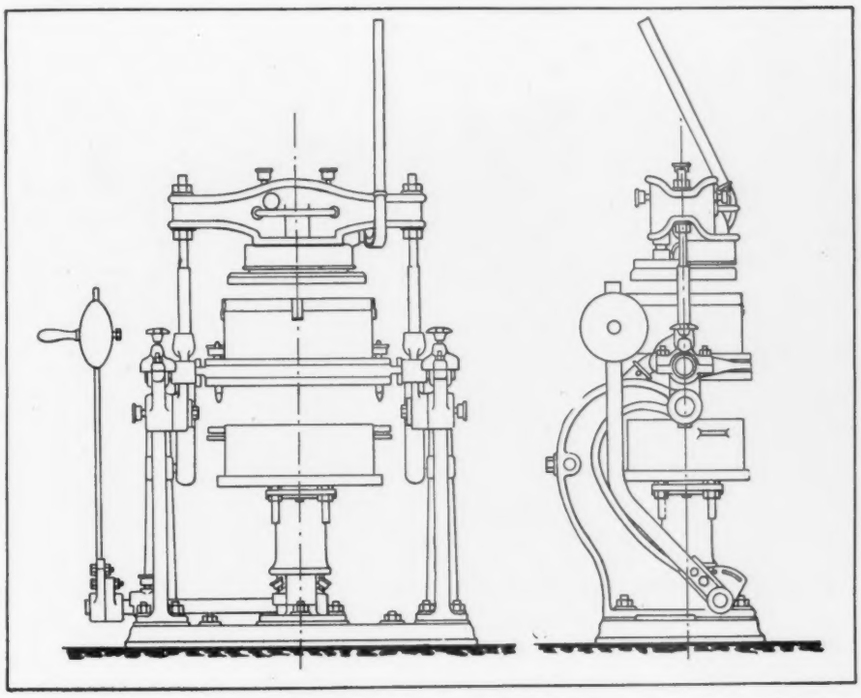


FIG. 11—GERMAN HAND SQUEEZER DESIGNED TO WORK MATCH PLATES

FIG. 12—A HYDRAULIC SQUEEZER MACHINE OF GERMAN CONSTRUCTION

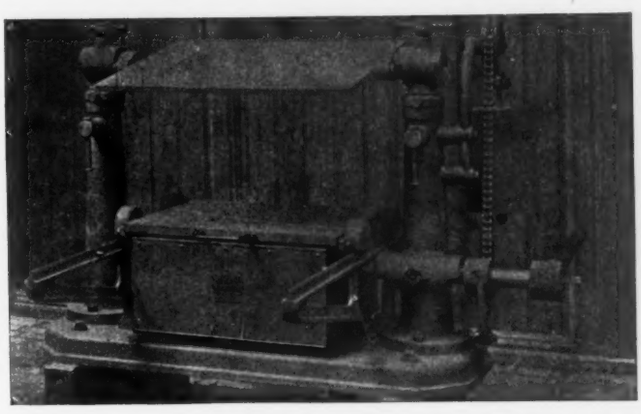
machines in fact are built and fitted along the lines of a machine tool. This feature, it may be said, is characteristic of British molding machines in general. An effort seems to have been made in many cases to raise the mout of the rough-and-ready class and to make machines in the true sense of the word.

Fig. 3 shows an adaptable molding machine of the type previously described arranged with a double lift attachment for molding air-cooled motor-cycle engine cylinders. The box sets on the flask rests during the ramming operation. The fins are mounted on a pattern-plate and are drawn through the stripping-plate as shown. When this operation is completed the flask, or molding-box as it is called in England, is lifted clear of the stripping-plate. By operating the lever, the fins are then brought back to their normal position, and the machine is ready for the next mold. For making vertical green-sand cores these machines are fitted with stooling arrangements of the ordinary type.

Pneumatically operated squeezer machines of the ordinary types are manufactured in Great Britain. Also a large number of hand-squeezers with various types of multiplication gear are turned out. A machine of this latter type is shown in Fig. 5. It is built by the Britannia Foundry Co., Coventry, England. Its general construction is similar to that of the ordinary squeezer machine, except that it is provided with a mechanically geared head, which enables a pressure of five or six tons, it is stated, to be easily applied to the mold by pulling on the levers *L*. The height of the central column, which supports the flask rest can be adjusted by the side lever *V*. This machine is designed for flasks 11 x 14 x 16 inches, the depth of ram being 7 inches and the height of lift 8 inches.

Jar-ramming machines of various types are extensively produced in Great Britain. Their design in general appears to be more along the established lines with which the American foundryman is familiar than most other European machines. British jar-ramming machines are mainly of the pneumatic type, although recently electrical machines and some ingenious combination electric and pneumatic machines have been developed.

A typical British plain jar-ramming machine of the smaller size is shown in Fig. 4. This machine was developed during the war by the Britannia Foundry Co. for use by women. It is pneu-



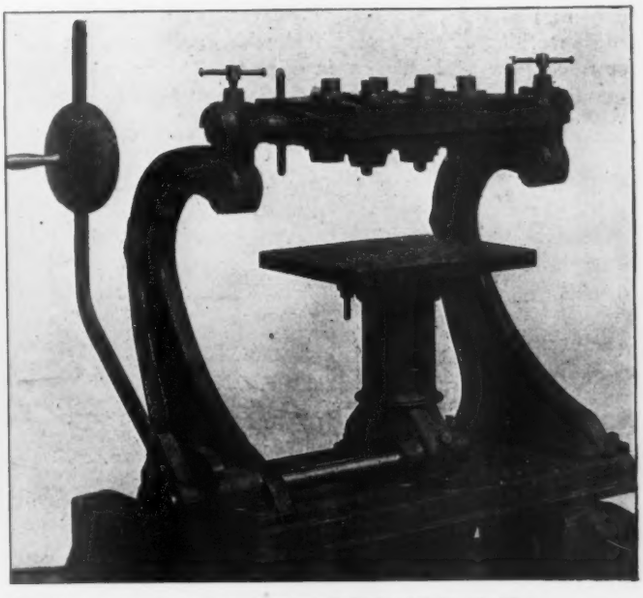


FIG. 13—A GERMAN PLAIN ROLL-OVER MACHINE FIG. 14—ANOTHER GERMAN ROLL-OVER MACHINE WITH MATCH PLATE

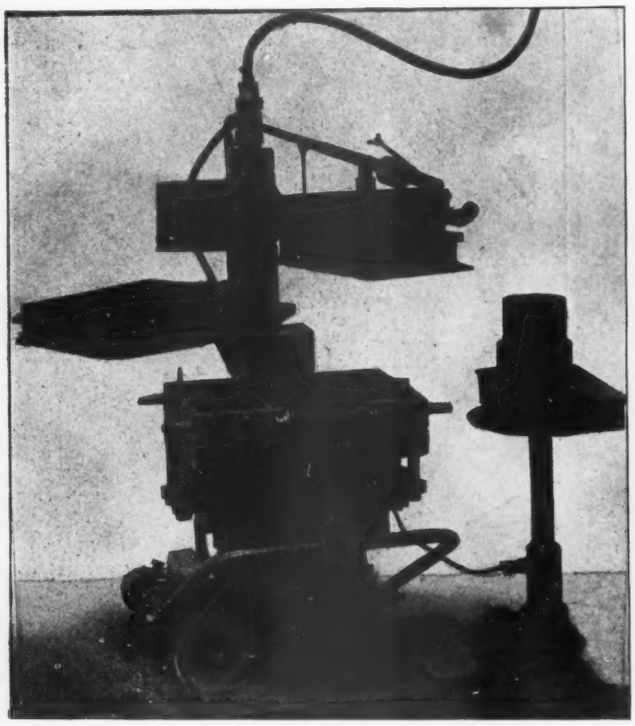
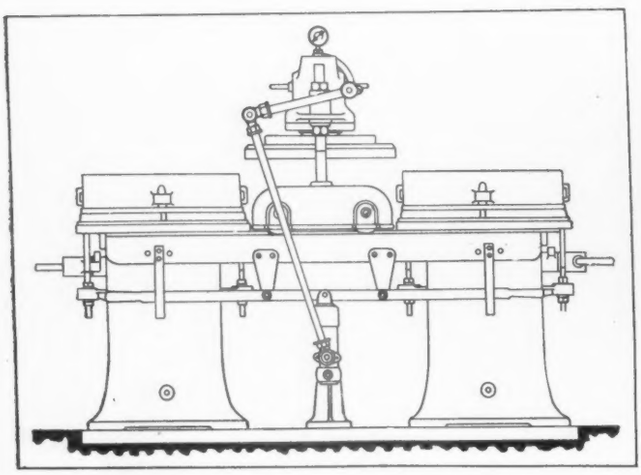


FIG. 15—HYDRAULIC SQUEEZER MACHINE WITH ROTATING ELEMENTS FIG. 16—A GERMAN STRIPPING-PLATE MACHINE

matically operated and its air consumption is stated to be six cubic feet of free air per minute. Air at 60 pounds pressure is required. The table is 17 x 21 inches and the lift is six inches. It is designed to handle molds weighing up to 600 pounds, and is especially adapted to core molding. The flask is guided at the corners by the vertical rods shown which are seated in adjustable slotted arms. The capacity of this machine is given as 130 molds per 8-hour day.

The demand in the United Kingdom for large quantities of marine engine, ship and other heavy castings has led to the construction of jar-ramming machines of the largest size. A very large British machine of this type, fitted with a turn-over table, is shown in Fig. 6. It is built by John Macdonald & Son, Ltd., Maryhill, Glasgow, Scotland. The table, which is of 2⅛-inch armor plate, These machines are also built with is 6 feet wide and 10 feet long 7 x 4 foot plates. This size is designed to jar--ram and roll-over molds weighing up to 10 gross tons, with 80 pounds of air. The jarring cylinder is 24 inches in diameter and under full load the machine gives three blows per second. The impact is taken on eight jarring columns arranged four on each side of the machine as shown. Four 10½-inch cylinders are provided for lifting the mold for turning over, or for drawing the pattern. Two of these cylinders are placed at each end of the machine. They are connected by a link motion to insure uniform action The valve on the main cylinder is designed so the air may be discharged gradually if desired. Therefore the pattern may be drawn either by letting the mold drop away from the pattern or by drawing the pattern out of the sand with the 10-½-inch drawing cylinders. The table is turned over by a bronze worm gear shown in the background in Fig. 6. It is said that only 10 pounds pressure on the hand wheel is necessary to turn-over the mold. The worm wheel is out of gear when the table is in the jarring position.

A machine somewhat similar to that illustrated in Fig. 6 also has been designed by the Macdonald company with an electric jarring mechanism of the cam type. With a 10-horsepower motor, this machine handles flasks up to four tons. The table is 12 feet long and 3 feet wide, the machine having been built for special work, and pneumatic



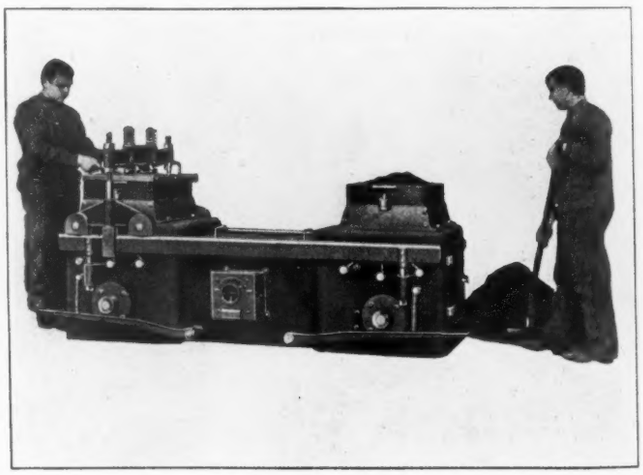


FIG. 17—A DOUBLE HYDRAULIC SQUEEZER MACHINE FIG. 18—AN ELECTRIC SQUEEZER MACHINE OF THE TWIN TYPE

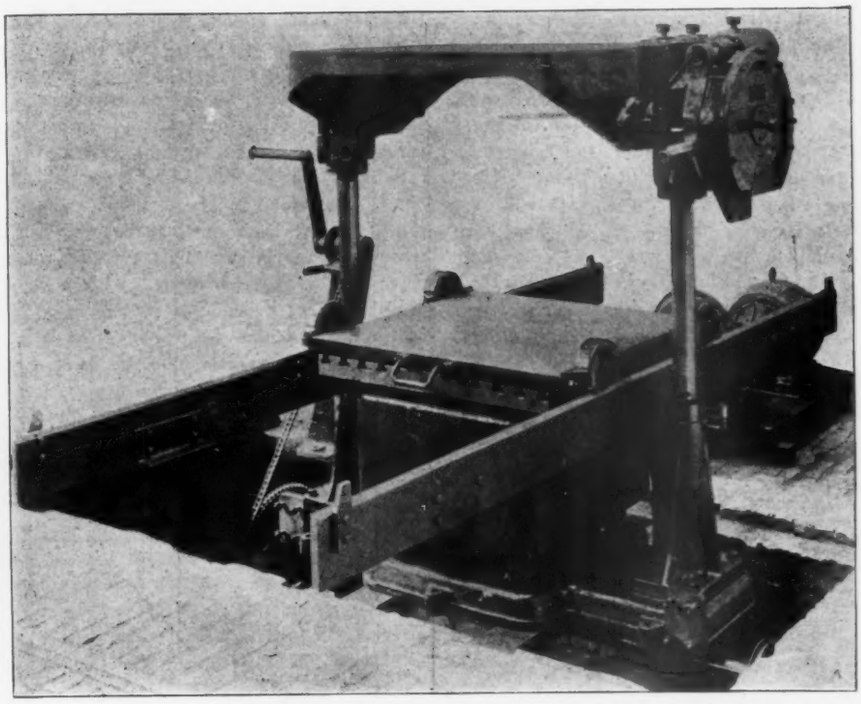


FIG. 19—AN ELECTRIC JAR-RAMMING MACHINE WITH TURN-OVER TABLE

pattern drawing cylinders are provided.

An electro-pneumatic jar-ramming machine is now being built in England by the Midland Motor Cylinder Co., Southwick, near Birmingham, England. It is perhaps the most recent machine developed in Europe and possesses a number of new features. It is of the jarring and pattern-drawing type and was designed originally to handle heavy motor-car cylinder molds, although of course it may be applied to any class of work. A view of this machine is shown in Fig. 7. The machine is built in various sizes, what may perhaps be termed the standard size being fitted with a 24 x 26-inch table. This machine is designed to handle with a 6-horsepower motor molds weighing up to 1600 pounds. The jarring table is mounted on a plunger fitted in a cylinder in the usual manner. The motor, which is bolted to the base of the machine, is geared to a plain eccentric which in turn operates a piston sliding in the cylinder under the table plunger. As this piston descends it draws in a charge of air through a check valve. This air is compressed on the upward stroke and when the predetermined pressure is reached, the jarring table is raised. It drops back when the exhaust ports are uncovered by the plunger, and the cycle of operations is repeated. The compressing piston is prevented from coming into contact with the table plunger by the intervening cushion of air. In brief, this machine operates like a two-cycle gas engine reversed. The amount of air and therefore the density of ramming can be regulated by adjusting the inlet valve by means of a hand wheel. This machine is also equipped with a pattern-drawing mechanism with a 14-inch lift which is operated from the driving motor through gearing and special trips, two levers being employed to control the ramming and drawing operations.

Another British inventor, William O'Keefe, Stanhope Street, Birmingham, England, has recently patented a hand-operated jar-ramming machine, fitted with a roll-over and pattern drawing attachment. In appearance this machine looks somewhat like a standard American combination jar-ramming and roll-over draw machine. In place of the usual pneumatic cylinder, however, a tripping cam mechanism is placed under the jarring table and so arranged that it operates a pair of forked levers which lift the table at its four corners and let it drop back when the trip releases the ends of the levers. The table is lifted only a short distance. The tripping cam is driven by a hand crank through a chair gearing, and since the machine is not designed for large flasks it is not difficult to operate. The rammed mold is also turned-over by the hand crank, suitably counterbalanced, and deposited on a pattern-drawing table which is supported by a plunger resting on an adjustable spiral spring. This spring is so adjusted that the weight of the mold draws it away from the pattern when the clamps are released. The purpose of the designer has been to produce a practical machine which can be sold cheaply to automobile foundries and others handling light work. If desired, an electric motor is substituted.

Special British Molding Machines

It is not possible, within the limits of this paper, to describe all of the various types of special molding machines which have been developed in Great Britain. A few, however, can be referred to briefly.

A machine built by Duncan Stewart & Co., Ltd., Glasgow, Scotland for molding pulleys and gear wheels of large size is illustrated in Fig. 9. It consists essentially of a square cast-iron base, a central column, a dividing drum for laying out gear teeth, and a cross arm fitted with traveling carriage and counterweighted. The central column is made in two parts and accurately turned. The dividing drum is cast iron, made as light as possible, and is 4 feet 11 inches in diameter, with an 18 inch face. The

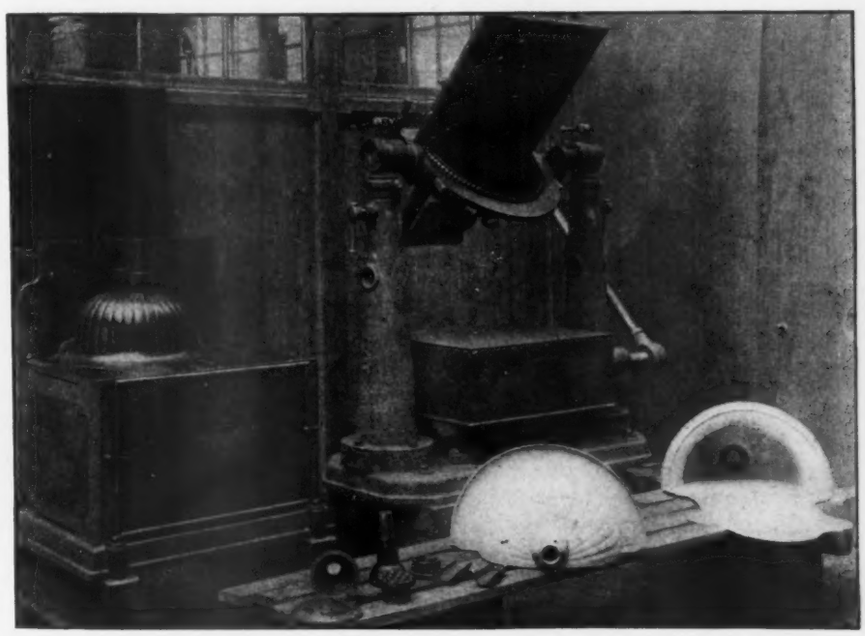


FIG. 20—PAIR OF MACHINES FOR MOLDING WASH BASINS

surface of the drum is divided into 50 rows of holes, the first row containing 51 holes and the last row 100 holes. These holes are accurately drilled in a dividing machine. The jib is fitted with a lead screw by means of which the carriage is traversed radially. The carriage is provided with a square plunger to the lower end of which the tooth block is fixed. The plunger has a vertical movement of 18 inches, for molding the teeth one, two or three at a time, this movement being produced by a handwheel and rack pinion. The plunger can be locked in any position. The jib also carries a bridge piece which in turn supports the dividing pin. This pin is tapered and is held in the proper dividing hole by a spring. A table showing the proper dividing holes to be used has been worked out for molding gears containing from 3 to 300 teeth. Other combinations of course can be worked out mathematically.

A special machine developed by the Adaptable Moulding Machine Co., Birmingham, England, for molding piston cores for automobile engines is shown in Fig. 10. A split core box, the two halves of which slide on steel guide rods, is provided. In Fig. 10, the core box is shown on the right-hand side of the machine in position ready for ramming. After this is done, the box, which is counterweighted, is turned over, and by means of the lever the box is opened, leaving the finished core on the core-receiving stand shown at the left. The balance weight is adjustable on the arm.

British railways use bull-head rails which are supported in cast-iron rail chairs, instead of employing flat-bottom rails which can be spiked direct to the ties as in the United States. A very large tonnage of these rail chairs is made every year in the United Kingdom. Fig. 8 shows a special roll-over type molding machine which has been developed for this work by Smith-Patterson Co., Blaydon-on-Tyne, England, the detailed practice followed in using this machine was explained in the Sept. 15 issue of THE FOUNDRY.

German Molding Machines

Germany is an important factor in the European molding-machine field, but little has been published regarding developments in this country for the past six years. A few notes on modern German molding machines accordingly have been collected. German machines fall into the general classifications enumerated in the introduction to this article. Hydraulic pressure, however, is favored for ramming the molds, and various types of hydraulic squeezer and combination hydraulic squeezer and roll-over machines are built. A new feature is an electric squeezer machine which will be described later.

One of the most common types of German molding machines for light work is illustrated in Fig. 13. The mold is rammed by hand, the flask being placed on the upper table, which swings in trunnions. After the flask is rolled over, the pattern is drawn by manipulating the hand lever shown at the right. The finished mold is rolled out into the open by the trolley arrangement shown.

A plain hand squeezer machine is shown in Fig. 11. It is equipped for molding with match plates for ramming the cope and drag at one operation. The upper head can be tilted back out of the way for removing the flasks. This type of machine also may be provided with a hydraulic squeezer head as shown in Fig. 12. This machine is provided with a mold carriage, and is said to have an output of up to 200 molds a day. A plain roll-over machine, using a match-plate, and arranged for hand ramming, is shown in Fig. 14. The frame is curved so that the mold-trolley may be dispensed with. The pattern is drawn by lowering the receiving table by means of the weighted hand lever shown at the left.

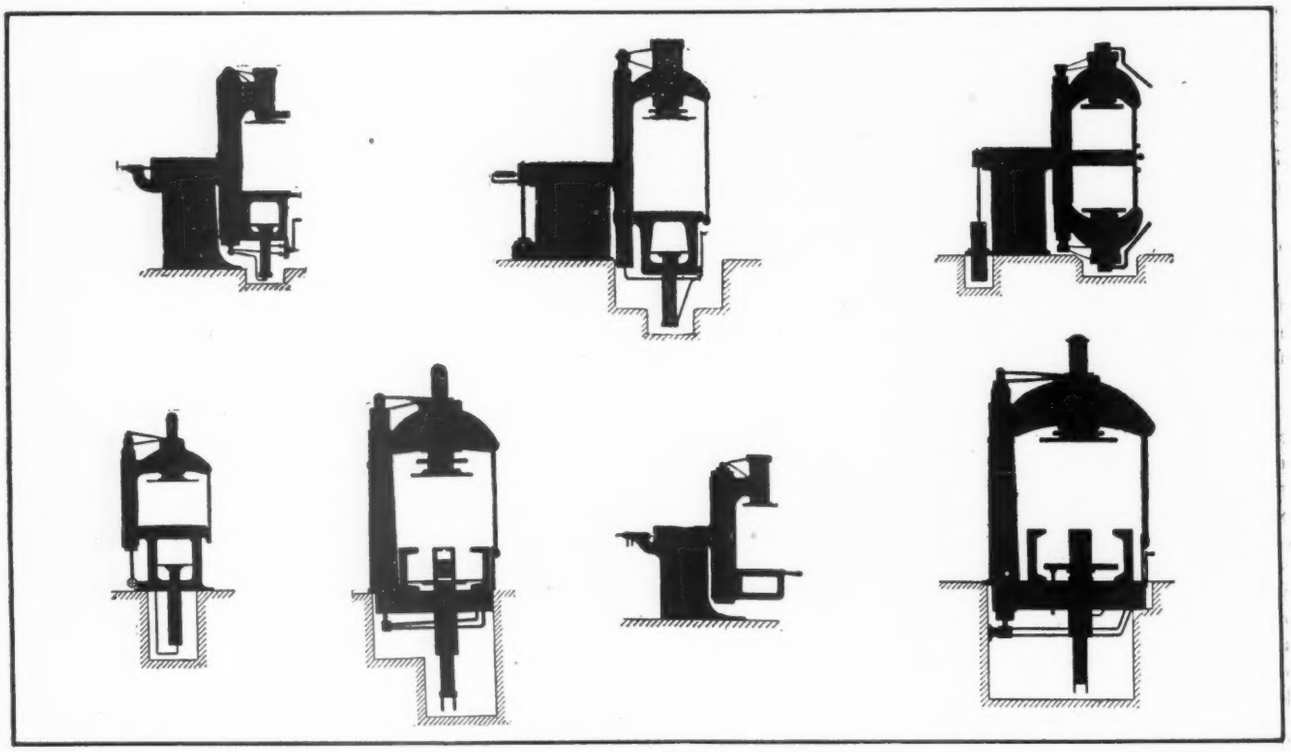


FIG. 21—SILHOUETTES OF FRENCH HYDRAULIC SQUEEZER MACHINES OF VARIOUS TYPES

One of the numerous types of swing-head squeezer machines, with hydraulic raming cylinders, made in Germany is shown in Fig. 15. It will be noted that both the upper head and the pattern-plate table swing on the upright column. This machine is designed for shallow work, using match plates so that the cope and drag can be rammed together. The squeezing cylinder is in the base, the water being led in through the upright column. The forged link shown in the foreground is clamped to the outer end of the squeezing head when the machine is in operation.

A plain stripping plate machine rigged

up for molding air-cooled motor-cycle engine cylinders is shown in Fig. 16. The sand is rammed by hand. The stripping mechanism is operated by the hand lever shown on the front of the machine. The table is fitted with extra long, machined guide pins, by means of which the flask is drawn off the pattern accurately after the fins have been stripped out.

A double hydraulic squeezer machine for molding two flasks at one time is shown in Fig. 17. This machine is designed for molding flat pieces and with two men the output is said to be 80 flasks in seven hours. The flasks are 20 x 20 inches. The patterns are drawn by lifting the flasks off of long machined guide pins. One man works on each side of the machine, a single traveling, hydraulic squeezing head being provided. It is traversed on the trolley shown in the illustration and may be placed in postion when either mold is to be rammed. The water is lead to the squeezing cylinder through articulated pipes provided with stuffing boxes.

Electric Squeezer Machine

An interesting modification of the foregoing machine, substituting electric for hydraulic power is shown in Fig. 18. This machine takes flasks 16 x 20 inches in size and is operated by two men as shown. A production of from 20 to 25 molds per hour is claimed. The machine is designed for shallow work and the drags are molded on one end and the cope on the other. The pattern is drawn by long pins as previously described. The squeezing head travels from one side of the machine to the other on rails. The ramming plungers are located underneath each flask in the base of the machine and are engaged with the motor by means of the foot levers placed within reach of the operators. The squeezing head is cushioned with spiral springs. When the head is rolled to the central position, the motor engages a linkwork mechanism which lifts the flask off the bottom-board and thus draws the pattern.

Another electric machine is shown in Fig. 19. It is of the electrically driven jar-ramming type, employing the usual cam lifting gear. This machine is provided with a turn-over table and pattern-drawing device. A shockless feature is introduced by cushioning the striking anvil on heavy spiral springs.

Special Machines

A number of different varieties of special machines have been developed in Germany for molding cast-iron sanitary ware and hollow ware such as pots. A roll-over machine for molding wash basins is illustrated in Fig 20. Two men, it is stated, turn out from 22 to 30 basins a day. The mold is in two parts and the outer part of the basin is molded on the stripping-plate machine shown at the left. The pattern is stripped downward by a hand lever. The mold for the inner part of the basin and wall-plate is made on the roll-over machine shown at the right. The back plate of the pattern is tilted out of the way before the rammed mold is lifted off.

French Molding Machines.

Molding machines are made in France by only three or four manufacturers. The usual types of plain stripping-plate and lever operated swing-head squeezer machines are produced. Jar-ramming machines do not appear to be made in quantity. By far the majority of the French molding machines are of the hydraulic squeezer type. A number of interesting silhouettes of these machines are shown in Fig. 21. As these sketches indicate, the machines fall into two general classes, namely, rotating head or turn-over machines so designed that the entire machine may be rotated on a horizontal axis by hydraulic power.

These machines of course are adapted to a wide range of patterns. They are specially suitable, however, for match-plate operations and many of the machines are so designed that both the copes and drags may be squeezed at one time. These machines are provided with two hydraulic squeezing cylinders located at the top and bottom respectively, so arranged that they may be employed, after the mold is rammed, to draw both halves of the flask away from the stationary frames holding the match plate. The latter rotates around the main column of the machine and may be readily swung out of the way as soon as it is disengaged from the mold. This permits the two halves of the mold to be brought together again. The top squeezing head can now be swung to one side and the mold pushed bodily out of the flasks by the bottom cylinder. In this way a small amount of flask equipment is made to serve for a large floor of molds, following the principle of the snap flask. This apparatus has been developed by Ph. Bonvillian et Ronceray, Paris.

The match plates are made of white metal from master patterns. They are so designed and molded that no machining is required in their production; nevertheless accurate patterns are produced.

Where the flask must be rolled-over for drawing the pattern, the frame carrying the hydraulic cylinders is mounted on a trunnion bearing which is so arranged that the machine may be turned-over bodily and turned back again its own hydraulic power. The water in this case is led to the cylinders through the trunnion shaft, which is hollow.

Malleable Made By the Triplex Process

(*Concluded from page* 817)

The metal being brought to the desired composition by suitable additions, is poured out into a crane ladle. A sample is taken for final analysis and the crane ladle is delivered to the foundry for pouring. From this point on the procedure differs in no essentials from that of ordinary malleable practice, except, of course, that it is not usual with any other method of melting to handle the metal into the foundry in 6-ton crane ladles.

Summing up the three stages of the process again it will be seen that the cupola has acted merely as a melting medium; the side-blow converter has served to adjust the carbon content of the metal; and the electric furnace has deoxidized and desulphurized the product and furnished also an opportunity for the exact adjustment of the final composition.

It will be noted also that the electric furnace does not pretend to make a product differing in any chemical respects from that obtained as the result of good air furnace practice. The electric furnace can make a much wider range of material than can the air furnace. Indeed it could be operated to make material of almost any analysis which could be written down. As a matter of fact its superiority in the malleable industry arises not in that it makes a product essentially of a new character, but rather in that it permits of very closely regulating the uniformity of the material which is turned out. From the standpoint of accuracy of control, the operation is infinitely superior to the very best possible air furnace operation.

The general application of electric furnace metal in the industry is limited by a number of considerations; even aside from the patent protection involved. To be economical an electric furnace must be kept in reasonably continuous operation. This necessitates a 24-hour operation during the entire week. Further, there is a minimum size of furnace below which operation is no longer either practical or economical. These two considerations limit the application of the method to plants of large output.

When properly operated either the 6-ton or the 15-ton furnace produces a heat in a little over an hour. A further interval of about half an hour is required for patching the bottom of the furnace and pouring in the next charge. Thus the furnace can turn out a heat every 90 to 100 minutes if no delays are encountered. If operated on a slower schedule the increased cost becomes prohibitive.

Heat Treating Steel Electrically

Normalizing, Annealing, Quenching or Hardening at High Temperatures Followed by Drawing Are the Processes Followed in Heat Treating Steel Castings

BY E. F. COLLINS

THOUSANDS of tons of steel castings are produced annually for use where particularly severe conditions have to be met. In order that castings may possess the best physical properties of which the steel is capable, some form of heat treatment is usually required. High grade steel castings may be of lesser quality physically through improper, or no heat treatment at all, than a cheaper and inferior steel which has been properly heat treated. Structural changes accompanied by varying physical characteristics, due to heat treatment, are governed by definite laws, but it must be recognized that a given heat treatment cannot be applied to all steels with the same satisfactory results; yet a given treatment corresponds to each particular kind of steel, and each responds best to its own individual temperature and time cycle.

Heat treating of steel castings embraces the individual processes of normalizing, annealing, quenching or hardening at high temperature, usually followed by drawing at a lower temperature. Knowledge of critical points and transformations is required in order to secure the highest physical properties.

Ordinarily the finer the grain the stronger the steel, and to obtain the refinement the heating and cooling cycle for the steel must be determined as narrowly as possible. It naturally follows that the operator must have facilities which eliminate so far as possible variables in carrying out the process required, if uniformity of product and full worth of the steel is to be secured. Steel is frequently normalized to put it into the best condition for subsequent heat treatments. The process consists in heating steel to well above critical points, and cooling at the proper rate to a temperature below redness; this breaks up networks and large crystals into finer grained structures. Annealed cast steel parts may be cooled in the furnace in which they were heated or in special cooling devices separate entirely from the furnace installation.

FIG. 1—ETCHING OF STEEL AS CAST

The purpose of annealing steel castings is to increase softness and ductility and facilitate machining operations, to eliminate existing coarseness of grain and slip bands, secure the desired combination of ductility and elasticity for resisting strains, and to relieve internal strains such as may be caused by non-uniform contraction in cooling of the casting in the mold. The temperature ranges for annealing shown in Table II are recommended by the American Society for Treating Materials. In explanation of two temperatures for the same carbon content the intention is generally to have small castings with 0.12 per cent carbon treated at 840 degrees Cent. and large castings at 925 degrees Cent. Crystalline growth and grain size depends on the length of time which steel is subjected to a temperature sufficient to induce change in structure. This time is usually longer in large castings than in small ones.

Figs. 1 to 10 show etchings, magnified 125 diameters, indicating the change of structure and its progress with time and temperature. Table I explains the microphotographs of etched steel, from a casting of large size, which was annealed to give

From a paper presented at the Columbus, O., meeting of the American Foundrymen's association meeting Oct. 4-8, 1920. The author, E. F. Collins, is consulting engineer on industrial heating devices, General Electric Co., Schenectady, N. Y.

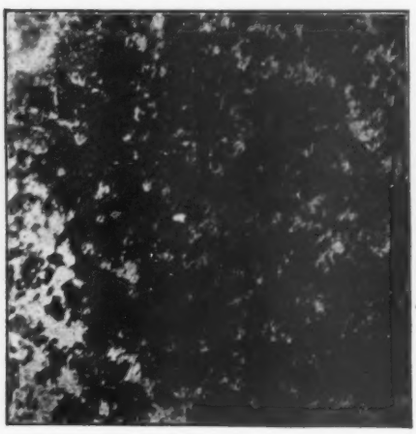


FIG. 2—ANNEALED 5 HOURS AT 825 DEGREES CENT.

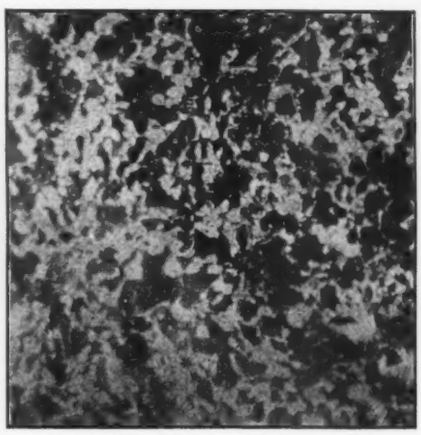


FIG. 3—ANNEALED 10 HOURS AT 825 DEGREES CENT.

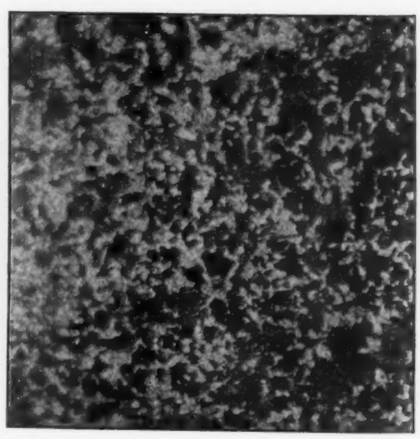


FIG. 4—ANNEALED 15 HOURS AT 825 DEGREES CENT.

proper grain refinement and structure uniformity. One instinctlvely recognizes from Figs. 1 to 10 that even Fig. 2 shows a structure that is stronger and more elastic than the untreated casting whose structure is shown in Fig. 1.

Table IV illustrates the manner in which the physical properties of a 0.30 per cent cast steel may be changed by treatment as follows:

1. No heat treatment, sample as taken from mold.
2. Casting normalized at temperature of 900 degrees Cent.
3. Casting annealed for five hours at 850 degrees Cent.
4. Casting annealed for five hours at 850 degrees Cent. followed by anneal for five hours at 950 degrees Cent.
5. Casting given double heat treatment, that is, first quenched in oil from 850 degrees Cent. and then drawn back at 600 degrees Cent.

These results also show conclusively that much advantage may be secured in physical properties of cast steel through proper heat treatment.

Factors affecting the uniformity and quality of the product resulting from heat treatment applied to steel castings are:

1. Structure of cast part to be treated.
2. Carbon content and distribution in steel of phosphorus or other impurities.
3. Physical characteristics called for by specification for the part under treatment.
4. Size and shape of steel castings.
5. Furnace characteristics—design—
   (a) Furnace atmosphere—full effect.
   (b) Temperature distribution.
   (c) Rate of heating and cooling.
   (d) Capacity of furnace related to time cycle and production.
   (e) Mechanical handling of furnace charge.
      (a) Hand.
      (b) Automatic, that is, conveyor type.
   (f) Tempeature control.
      (a) Hand control.
      (b) Automatic control with pyrometer.
   (g) Method of determining temperature of work.
      (a) Observation by the eye.
      (b) Optical pyrometer.
      (c) Radiation pyrometer.
   (h) Heat penetration and absorption.
      (a) Corrected heat.
      (b) Radiant heat.
   (i) Duplication of heating cycle—heating—soaking—cooling.
   (j) Amount of scale influencing heating and cooling.
6. Human operation and control of process.
7. Cost overall.

Aside from consideration of quality and uniformity of product, the economic question of overall cost for carrying out the process is important when deciding whether or not to heat treat. Selection of equipment best suited for special or general work is equally important. Each of the foregoing factors is more or less interrelated and each plays a prominent part in the resulting quality and overall cost which may be reduced in the proportion in which the variables in the process are eliminated by automatic means or definitely controlled by the operator. Steel castings generally require different temperature and time cycles for their heat treatment than forgings. When forgings have been finished at too high a temperature they are usually coarse grained, somewhat like castings, whereas if finished at too low a temperature they may be hard and this can be corrected by normalizing.

In order to determine the need for annealing or normalizing, the structure and general nature of the part should be known. This also aids in determining proper heat treatment.

If the carbon content of steel is widely different in pieces treated in the same charge, or is not uniformly distributed throughout the single pieces, correspondingly high and low critical points exist between which a compromise must be made in the heat requirements of the high and the low critical points. The critical temperature decreases progressively from about 900 degrees Cent. for 0.0 per cent carbon. If steel with a high carbon content be cooled rapidly, a more tender steel is obtained. Air cooling may result in hardening.

When maximum softness and ductility are wanted, the best results with small pieces are produced by slow cooling in the furnace. This may not be true of large pieces, because the same rate of fall of temperature may not be sufficient to prevent overgrowth of crystals, therefore methods of cooling should be employed which will give, the equivalent of furnace cooling for small pieces. In furnace cooling or complete annealing, strength and elasticity are reduced and a modified ductility must be

Table II

Ranges of the Temperature in Annealing

Carbon Content Range Per Cent	Annealing Temperature Range Degrees Cent.	Degrees Fahr.
0.00 to 0.12	875 to 925	1607 to 1697
0.12 to 0.29	840 to 870	1544 to 1598
0.30 to 0.49	815 to 840	1499 to 1544
0.50 to 1.00	790 to 815	1454 to 1499

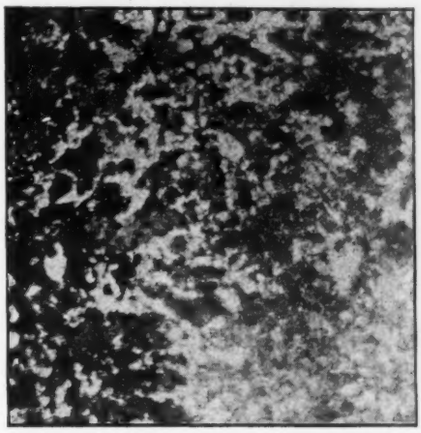


FIG. 5—ANNEALED 20 HOURS AT 825 DEGREES CENT.

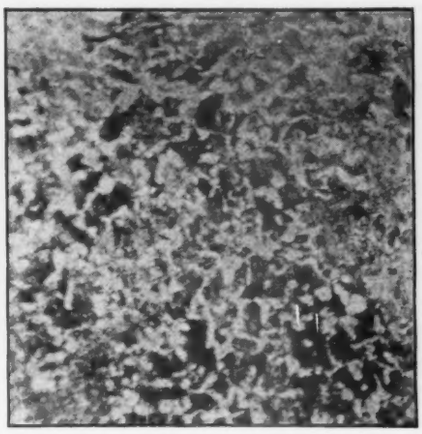


FIG. 6—ANNEALED 25 HOURS AT 825 DEGREES CENT.

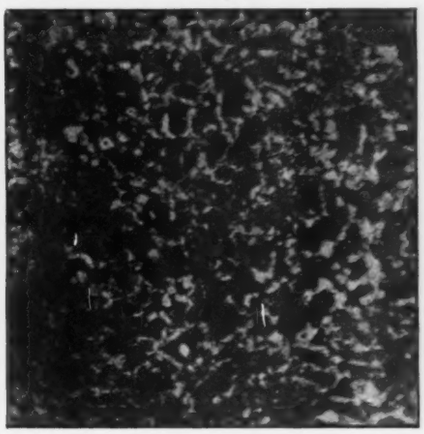


FIG. 7—ANNEALED 30 HOURS AT 825 DEGREES CENT.

Table I

Explanation of Etchings Shown in Figs. 1 to 10

Micro Photo	Time Annealed	Annealing Temp. Deg. Cent.	Carbon Content Per Cent	Remarks
Fig. 1	As cast		Approx. 10	Note large crystals.
Fig. 2	5 hours	825	Approx. 10	Crystals broken up cleavage slip exists.
Fig. 3	10 hours	825	Approx. 10	Structure changing cleavage slip disappearing.
Fig. 5	20 hours	825	Approx. 10	Structure changing cleavage slip disappearing.
Fig 6	25 hours	825	Approx. 10	Structure changing cleavage slip disappearing.
Fig. 8	35 hours	825	Approx. 10	Structure satisfactory cleavage slip gone.
Fig. 9	40 hours	825	Approx. 10	Grain size and uniformity satisfactory.
Fig. 10	40 hours and 5 hours	825 950	Approx. 10	Grain size and uniformity satisfactory.

FIG. 8—ANNEALED 35 HOURS AT 825 DEGREES CENT.

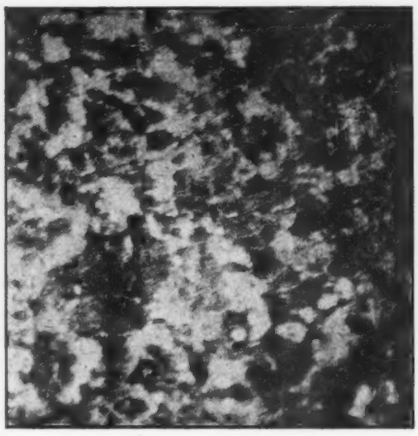


FIG. 9—ANNEALED 40 HOURS AT 825 DEGREES CENT.

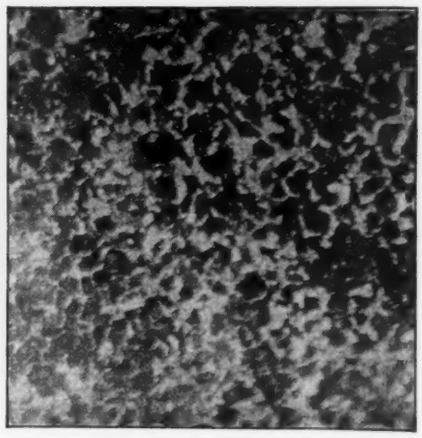


FIG 10—ANNEALED 40 HOURS AT 825 DEGREES CENT AND 5 HOURS AT 950 DEGREES CENT

Table III
Cost of Energy in Electric Furnace

Vertical cylindrical electric furnaces rated 400 kilowatts; heating chamber, 6 feet diameter x 25 feet high; power rate, $0.0085 per kilowatt-hour.

Furnace Charge pounds	Heating for Quench Energy kilowatt-hours	Pounds per kilowatt-hour	Temperature of heat treatment degrees Fahr.
21900	1874	11.7	1450
22300	1880	11.8	1450
21700	2088	10.4	1450
65900	5842	11.3 Average	

$= 32.95$ tons.

$$\text{Kilowatt-hours per ton} = \frac{5842}{32.35} = 178 \text{ kilowatt-hours.}$$

5842 kilowatt-hours at $0.0085 = $49.65.

$$\frac{\$49.65}{65900} \text{ or } \frac{49.65}{32.95} = \$1.52 \text{ per ton, for power charge.}$$

Drawing Back

Rate of drawing at 1150 degrees Fahr. = 21 pounds per kilowatt-hour.
Kilowatt-hours per ton at 1150 degrees Fahr. = 84 kilowatt-hours.
Cost per ton at $0.0085 per kilowatt-hour = $0.71.
Cost per ton for the two processes = $1.52 plus $0.71 = $2.23.

accepted and proper normalizing of small parts and its equivalent for large ones, usually gives results meeting the specification for physical properties.

Heat treating is done today in a variety of furnaces, and while some are well suited to the purpose, others have not a great advantage over the methods used by primitive man, who heated his work in an open flame, oxidizing or decarbonizing the metal and later on covered it with coals and allowed it to cool in a crude forge fire. Within the past few years, the electric furnace, admirably suited to heat treating, has made its appearance.

The electric furnace, in laboratory size has done excellent work for some time past, but the furnaces discussed

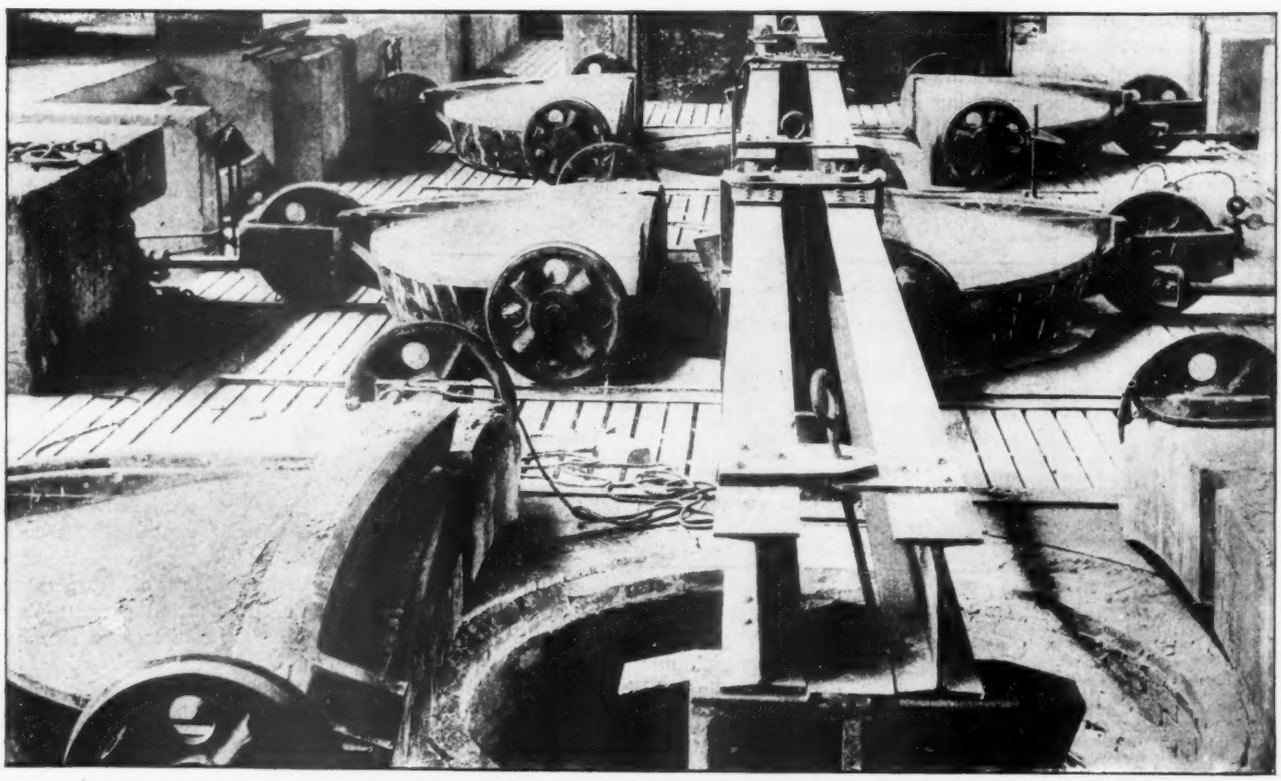


FIG. 11—THREE VERTICAL HEAT TREATING FURNACES FOR GUN FORGINGS—THE ENTIRE BATTERY INCLUDES FOUR FURNACES

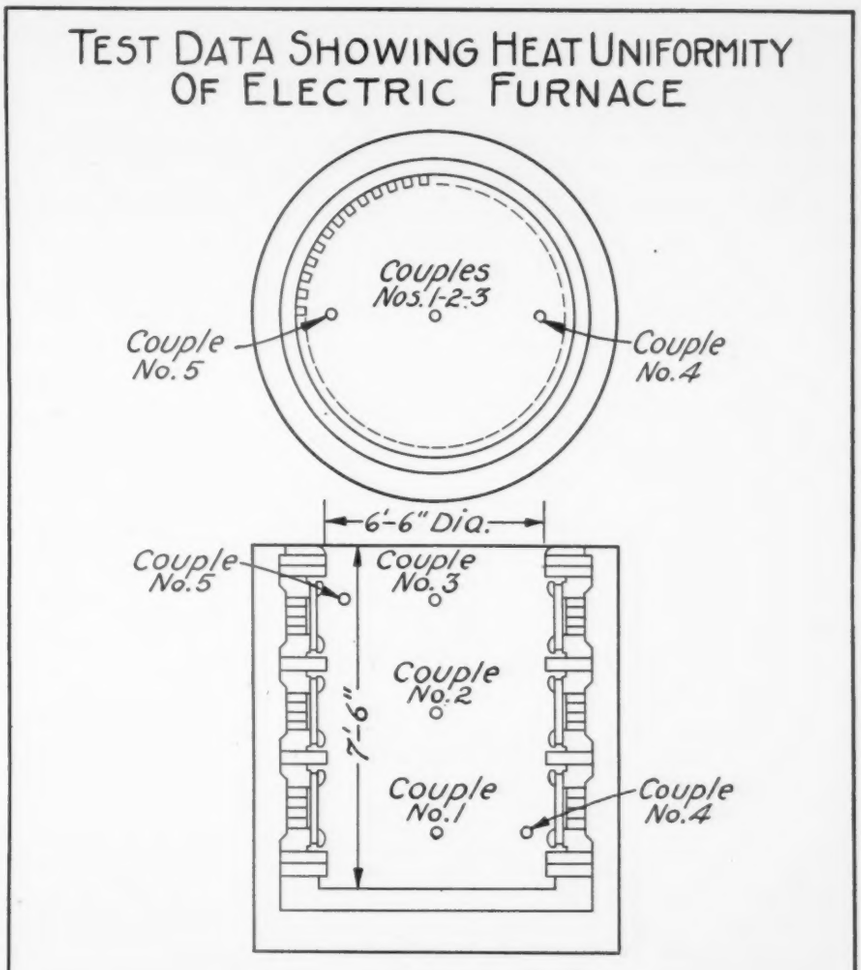
by the author are electrically heated furnaces of rugged design and construction, and of such capacity that they are handling large productions of heavy parts, and are so dependable they are not supported by reserve fuel fired furnaces.

The development and use of the electric furnace for heat treatment has progressed to the stage where furnaces are made with capacities up to 2700 kilowatts and accommodate charges of 320,000 pounds which may or may not be in one piece. The electric furnace, with tonnage and productive capacity sufficient for any industrial foundry, when intelligently used in heat treating of steel castings, will make it possible to develop the physical properties to a maximum for any grade of steel due to the fact that furnace variables, detrimental to the process, are practically eliminated. There are several general types of electric furnaces in which metals may be heated, but some form of resistance furnace is best adapted to heat treating steel. Certain work may be heated conveniently by induced currents in the charge itself, or by passing current through the parts, but the current induced or otherwise generated, does not flow uniformly through the structure, and hence does not produce the same uniform temperatures that obtain in the resistance furnace whose heat is delivered and distributed by radian means.

Radiant heat is absorbed by the furnace charge more readily than converted heat, and less precaution is necessary in heating high carbon steels. As an illustration of what radiant heat will do as regards rate of heating, a steel bar, 3 x 3 x 12 inches, may be heated in a 1200 degrees Cent. furnace until, in 17 minutes, it has the same color and temperature as the furnace. Examination of the piece shows thorough penetration of heat, without any burning or cracking having occurred at the surface. This could not be duplicated in fuel-fired furnaces without highly heating the outer surface, which results in burning or fusing and a change of carbon content.

The electric furnace of the resistance type, affords a heat treating atmosphere free from contaminating gases. The operator is freed from variation in his work due to absorption of sulphur, phosphorus, etc., from the products of combustion. The temperature distribution may be made uniform in the heating chamber if a properly designed electric furnace is used. The rate of heating and cooling may be controlled precisely either with or without the automatic attachment. The heat cycle once established may be repeated insuring uniform results in product. Electric furnaces may now be had in any size required by production in industrial foundries. Size of furnace does not influence heat control or distribution. Hence a furnace of ample capacity may be had for a given production so sufficient time may be taken for the heat cycle, to insure proper heat penetration and satisfactory time for grain change.

Electric furnaces are available of such design that work may be passed through them by a conveyor or pusher, as well as car bottom or hand feed furnaces. These conveyors may be automatically equipped to charge and discharge continuously or intermittently. In many cases they are standard conveyors as used in fuel furnaces. Automatic control and a graphic record of temperature are recommended. A thermocouple and a controlling recording instrument accomplishes the task. These, when adjusted for the desired temperature, will maintain it indefinitely, and relieve the operator of the



TIME	THERMOCOUPLES-TEMP °C					AVERAGE TEMP.	PRESENT DEVIATION FROM AVERAGE	
	1	2	3	4	5		ABOVE	BELOW
11 30	25	25	25	25	25	25	0	0
3 30	527	537	532	530	545	534	2.07	1.31
7 30	670	679	671	666	669	669	1.5	.45
11 30	777	783	776	766	780	776	1.0	1.3
3 30	858	864	857	849	864	860	.46	1.3
7 30	860	865	862	862	863	862	.35	.23
11 30	928	934	930	930	928	930	.43	.21
3 30	933	932	927	925	927	929	.64	.43
4 30	950	950	952	952	955	952	.31	.21

FIG. 12—TEST DATA SHOWING UNIFORMITY OF HEAT IN ELECTRIC FURNACE

responsibility or will enable one operator to handle a group of furnaces.

In an automatic temperature control electric furnace, the regulator was set to heat a charge to 1500 degrees Fahr. Shortly after 11 a. m. the cold charge was placed in the furnace. The temperature of the charge increased as did also the resistor, until the surface reached the desired temperature, 1500 degrees Fahr., at 4 p. m. Here the temperature of the source was automatically controlled so that heat was fed to the charge to compensate for the equalization going on within. At about 4:40 p. m. this equalization of temperature within the charge was complete. Automatically the charge was heated to a uniform temperature throughout, without allowing the surface of the charge to rise above the desired temperature.

The electric furnace offers a radiant heat of uniform intensity, in an unmuffled heating chamber. The characteristics of the electric furnace are such that they may be made almost entirely automatic. This means an exact duplication of heating and cooling cycles. Therefore when once established, a given heat treatment can be again applied, with assurance that uniform work will result.

Fig. 11 shows three of a battery of four vertical furnaces. The fourth furnace is beyond the quenching tank. These furnaces were used in heat treating gun forgings and gave results tabulated in Table III, which shows the actual cost for energy in furnaces of moderate size. The overall cost for the month of October, 1918, for day and night operation, without shutdown of any kind was $2.76 per ton. This was just before the armistice, when production was at the maximum rate. This economy is very high, but it could be realized in almost any moderate-sized plant, if well designed and continuously operated. It costs money to shut down any furnace and heat it up again, and the electric furnace is no exception.

One reason for high economy is the fact automatic control prevents waste of heat, by not allowing the charge or furnace walls to become heated to a higher temperature than necessary. This is a large factor, because at such temperatures additional temperature is gained only at progressively higher cost per degree.

Reference has been made to the uniform temperature distribution in these furnaces. Tests were made by heating a vertical cylindrical furnace from cold to 950 degrees Cent., in which thermocouples were distributed as shown in Fig. 12. The data are also tabulated in Fig. 12, and show that the distribution is almost perfect. In conclusion, it may be said that upon the furnace depends to a very great extent, the success of the heat treatment.

Gun Metal Temperature

Some interesting data on the temperature of molten gun metal have been contributed to the proceedings of the Institution of British Foundrymen by H. S. Primrose, Braintree, England, in the form of a written discussion of J. Arnot's paper on "Measurement of Casting Temperatures", read at the Glasgow meeting, Aug. 25-27. In this paper, Mr. Arnot infers that much of the early data on casting temperatures of gun metal are inaccurate and suggest 1000 degrees Cent. as the minimum, reasoning from the thermal diagram of copper-tin alloys. Mr. Primrose believes that the casting temperature may be as low as 950 degrees Cent. and says he should like to join issue with Mr. Arnot on this point. Continuing, Mr. Primrose says:

Gun metal is not at all comparable with a pure bronze, for its solidification diagram is a much more complex affair; the addition of zinc lowers the primary freezing point, and also alters the subsequent changes in the solid state.

Next, although gun metal commences to freeze at 995 degrees Cent. it is not then in a condition that the larger part of the alloy is solid. On the contrary, the greater portion of the metal is still liquid, and it remains so through a comparatively long cooling range. In fact the alloy has to cool down to practically 790 degrees Cent. before it is completely solidified, which means that although the primary crystals of copper-rich metal set at about 200 degrees higher temperature, the material passes through a prolonged pasty stage.

Dr. Longmuir in his Carnegie research memoir quoted the casting temperature of gun metal as being 965 degrees Cent. in one case where he got a tensile strength of 12.2 tons per square inch with low elongation. Some commenters on this inferred that there was either a misprint or error about the temperature, or that the pyrometer needed adjustment. Neither of these explanations was needed; for the temperature of 950 degrees Cent. can actually be attained with gun metal which will pour.

On the other hand it has never been claimed that this exceedingly low temperature, below 1000 degrees, is in the slightest degree a useful or an easy temperature at which to pour gun metal, since it is clear that some of the metal being solid at this stage, it will pour neither well nor soundly, but will slop over like porridge, with lumps in it. The subsequent cooling in the mold will be very sudden, leaving the metal in a very unstable (possibly also unsound) condition which possesses little strength and almost no ductility. The microstructures published in several transactions prove this as conclusively as do the physical tests, but it is remarkable how many persons have discredited these figures, both of Longmuir and myself, especially when the constitutional diagram referred to actually shows the possibility, although not the advisability, of castings below the freezing point.

Table IV
Effect of Annealing on Physical Properties

Sample	Heat treatment	of anneal Deg. Cent.	Carbon content	Tensile strength	Yield point	Elon. in 2" Per cent	Red. of Area Per cent
A1	as cast	No anneal	0.30	54,000	26,000	13	20
A3	Normalized	900	0.30	73,000	50,000	28	35
A1	5 hours anneal	850	0.30	73,500	41,000	24	38
A2	5 hours anneal 5 hours anneal	850 950	0.30	73,200	43,600	24	34
A2	Oil quenched and drawn	850 600	0.30	85,700	47,700	17	36

Melting Gray Iron in the Crucible Furnace

By H. E. Diller

Question:—I wish to make a few hundred pounds of gray-iron castings in my brass furnace and have some piston rings, stove plate and other scrap but no pig iron to make it from. Would it be possible to do this and, if so, should I add any ferrosilicon?

Answer:—It is entirely possible to melt gray iron in an oil-burning crucible furnace. If you have enough piston rings to make up the charge you would not have to use ferrosilicon. Should you use stove plate care should be taken to see that no badly burned pieces are used. Without knowing the exact kind of scrap which you will use we would not be in position to say whether it would be necessary to use ferrosilicon, but if you take scrap having a light section, the silicon in it will probably be high enough so that no ferrosilicon will be needed. Charcoal added with metal assists melting.

FORMULAS FOR THE BRASS FOUNDRYMAN

DATA ON COPPER, TIN, PHOSPHORUS ALLOYS

(*Continued from Data Sheet No. 352*)

ORDINARY CASTINGS

	Pounds	Ounces
Copper	85	13
Tin	10	3
Fifteen per cent Phosphor copper	5	0

The physical properties of this alloy are:

Tensile strength, pounds per square inch	36,736
Elongation, per cent in 2 inches	11.0

BEARINGS

	Pounds	Ounces
Copper	85	6
Tin	9	6
Fifteen per cent Phosphor copper	5	4

The physical properties of this alloy are:

Tensile strength, pounds per square inch	45,248
Elongation, per cent in 2 inches	12.0

BEARINGS

	Pounds	Ounces
Copper	85	7
Tin	9	9
Fifteen per cent Phosphor copper	5	0

The physical properties of this alloy are:

Tensile strength, pounds per square inch	45,024
Elongation, per cent in 2 inches	15.0

BEARINGS

	Pounds	Ounces
Copper	85	0
Tin	10	0
Fifteen per cent Phosphor copper	5	0

The physical properties of this alloy are:

Tensile strength, pounds per square inch	40,544
Elongation in 2 inches	11.0

(*Continued on Data Sheet No. 354*)

Note—This sheet may cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

FORMULAS FOR THE BRASS FOUNDRYMAN

DATA ON COPPER, TIN, PHOSPHORUS ALLOYS

(*Continued from Data Sheet No. 353*)

SHEAVES

	Pounds	Ounces
Copper	86	0
Tin	9	0
Fifteen per cent Phosphor tin	5	0

The physical properties of this alloy are:

Tensile strength, pounds per square inch	41,440 to 44,800
Elongation, per cent in 2 inches	24 to 26

WORM GEAR BLANKS

	Pounds	Ounces
Copper	88	8
Tin	5	0
Fifteen per cent Phosphor copper	6	8

The physical properties of this alloy are:

Tensile strength, pounds per square inch	56,000
Elongation, per cent in 2 inches	28.0

WORM GEAR BLANKS

	Pounds	Ounces
Copper	88	11
Tin	4	13
Fifteen per cent Phosphor copper	6	8

The physical properties of this alloy are:

Tensile strength, pounds per square inch	55,552
Elongation, per cent in 2 inches	36.0

WORM GEAR BLANKS

	Pounds	Ounces
Copper	88	8
Tin	5	0
Fifteen per cent Phosphor copper	6	8

The physical properties of this alloy are:

Tensile strength, pounds per square inch	55,104
Elongation, per cent in 2 inches	34.0

(*Continued on Data Sheet No. 355*)

THE FOUNDRY DATA SHEET, OCTOBER 15, 1920

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Lansing Shop Shows Advanced Ideas

BY PAT DWYER

IN THE presence of a large number of prominent foundrymen from the automobile centers of Ohio and Michigan, Edward VerLinden, president, removed his coat and with the veteran "Dan" Ryan, vice president and general manager for mentor, tapped the first iron melted in the Ryan-Bohn foundry of Lansing, Mich., at 3:30 p. m., Monday, Sept. 27. This event marked the culmination of plans laid about a year ago by Mr. Ver Linden to insure an adequate supply of castings for the successful operation of the Olds Motor Works of which he is president and general manager. On the strength of the reputation made by the Allyne-Ryan Co. of Cleveland, in the production of high grade automobile engine castings he decided to interest D. J. Ryan, president and general manager of the latter company in the project and leave the design of the building and equipment to his judgment.

The phenomenal success attending the operation of the Allyne-Ryan foundry in Cleveland, since its inception eight years ago, has attracted wide attention and the shop has been visited by foundrymen from all parts of the world. A comprehensive article describing this shop and the methods employed was published in the July, 1913, issue of THE FOUNDRY. Shorter articles dealing with certain specific phases of the work have been published in THE FOUNDRY since that time. Under the direction of D. J. Ryan and his immediate associates the business has expanded until the original melt of 25 tons a day has been increased to 150 tons. It has been the policy of the company to promote its own men to positions of responsibility. This policy has made it possible to transfer the nucleus of an organization from the parent shop in Cleveland to its two new plants operated by the D. J. Ryan Foundry Co., Ecorse, Mich., and the Ryan-Bohn Foundry Co., Lansing, Mich.

The Lansing plant was designed by D. J. Ryan and his executive staff. Plans were prepared from these designs and the building was erected by a local firm of contractors under the personal supervision of A. P. Vreeland, general superintendent of the new foundry, who also directed the installation of all the equipment.

The present unit has an estimated capacity of 225 tons a day but the company owns ample adjoining property along the Manufacturers' Belt Line railroad on the western outskirts of the city to accommodate five additional units if necessary. Tentative plans for a second unit are already under way. Construction of the first unit was commenced last fall, but weather and transportation conditions delayed building operations to such an extent that the completion of the work was retarded several months. As will be noted in several of the illustrations which were taken on the day the first heat was poured, a considerable amount of the equipment has not yet been installed.

Mechanical equipment has been installed to such an extent that it will be possible to operate with a minimum

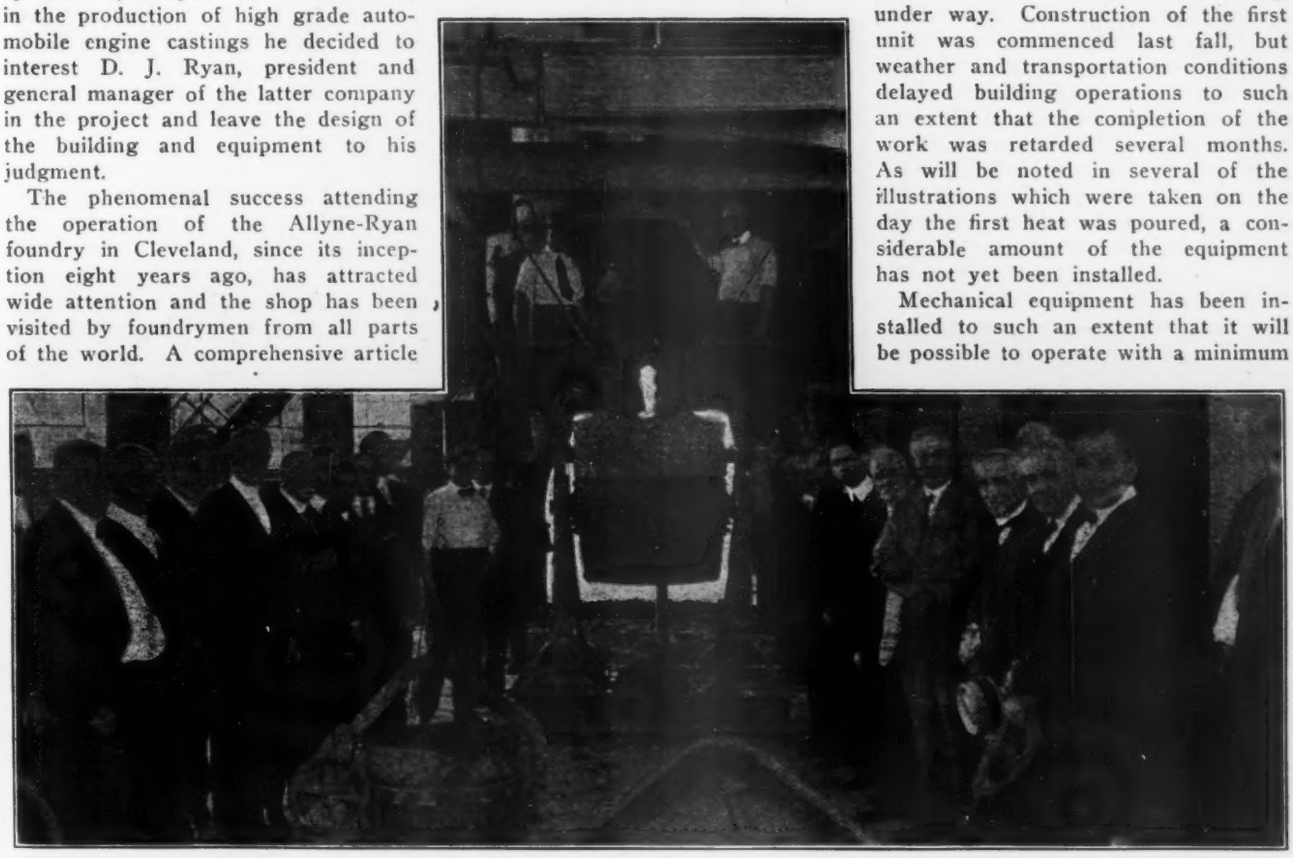


FIG. 1—THE FIRST IRON IN THE NEW FOUNDRY WAS TAPPED IN THE PRESENCE OF PROMINENT FOUNDRYMEN—EDWARD VER LINDEN, PRESIDENT OF THE COMPANY, IS SHOWN ON THE LEFT OF THE ILLUSTRATION WITH THE TAPPING BAR IN HIS HAND, WHILE D. J. RYAN IS SHOWN AT THE RIGHT OF THE SPOUT

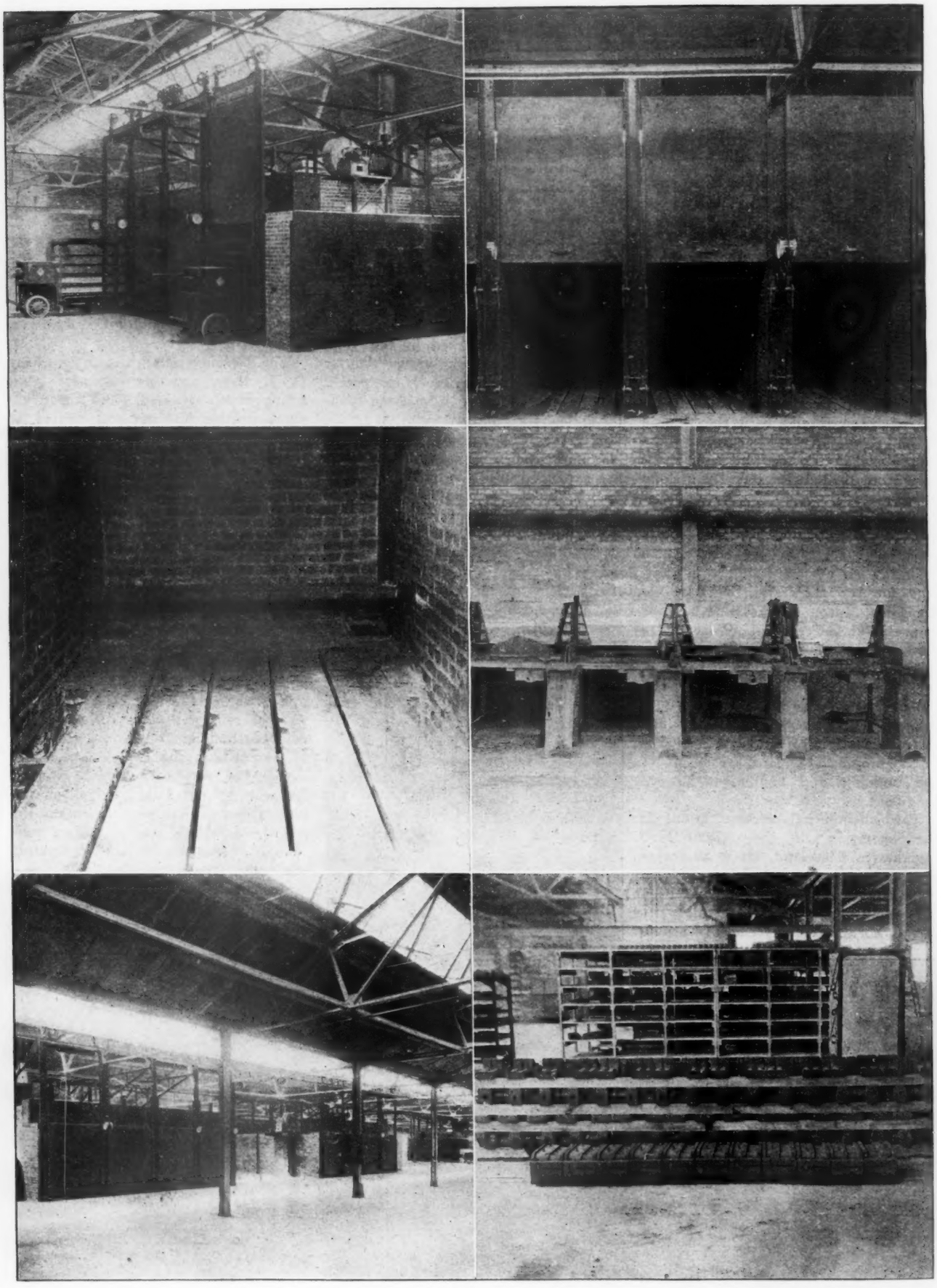


FIG. 2—ONE BATTERY OF OVENS CARRIES ON ONE SIDE A NUMBER OF SHELF OVENS—FIG. 3—INTERIOR OF ONE OF THE OVENS—FIG. 4—THE COMPLETE INSTALLATION COMPRISES THREE BATTERIES OF EIGHT OVENS EACH—FIG. 5—SHOWING THE PYROMETERS, DRAFT AND DOOR CONTROLS—FIG. 6—AN IMPROVED TYPE OF COREMAKER'S BENCH—FIG. 7— CYLINDER CORES FOR THE OLD'S EIGHT

number of laborers. It is estimated that whereas under ordinary circumstances the proportion of laborers is one to every 400 pounds of castings, the Ryan-Bohn Co expects to produce 2000 pounds of castings for every laborer employed. A Brown-Hoist locomotive crane is employed for unloading sand, coke, pig iron, scrap, limestone, fire clay and other raw materials used in a foundry. It is equipped with a magnet for the iron and a grab bucket for the other materials. At present coke is unloaded directly on to the ground, but it is planned to construct a large concrete storage pit below the level of the railroad track into which the coke can be dumped from the cars. A bucket elevator will then be employed for loading the charging buggies.

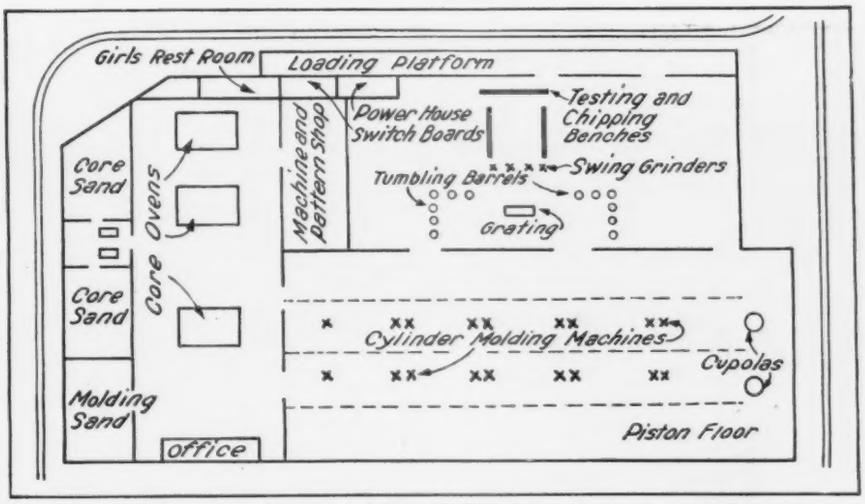


FIG. 8—GENERAL ARRANGEMENT SHOWING RELATIVE POSITION OF THE VARIOUS UNITS

The sand bins are filled through a continuous opening in the roof, which is provided with doors or hatch covers that are closed after discharging sand from the cars. The sand bin, Fig. 8, is divided into four sections. Molding sand is kept in the first, and core sand in the second and fourth with the sand mixing equipment located in the third, or between the two core sand storage divisions.

Eight cranes of special design span each of the cylinder molding bays in the foundry and, in addition, two 5-ton Toledo cranes are provided, one in each of the two center bays. Gravity conveyors are employed for transporting the castings from the foundry to the cleaning room, from the tumbling barrels to the chippers and grinders and from the chipping and testing bench to the loading platform.

The molding floor, paved with brick, covers an area of 160 x 300 feet and is divided into four bays of approximately equal width. The first bay is devoted to the molding of pistons which are made entirely in green sand on a specially designed machine made by the Osborn Mfg. Co., Cleveland. The pistons are made near one end of the bay as indicated in Fig. 8, the remainder of the floor being used for molds of all the various small parts entering into the construction of automobile engines and parts. The second and third bay are specially equipped for the production of cylinder molds, and while it is the intention to employ the fourth bay for making fly wheels, cylinder heads and all other castings too heavy to be poured with a hand ladle, nevertheless the floor has been arranged in a manner similar to that of the second and third bays and can be used for cylinder molding if necessary. The disposition of the molding machines for making cylinders is shown in Fig. 8. It will be noted that there is a battery of eight in each bay. These are of the jar-ram, rollover, pattern-drawn type, built by the Osborn Mfg. Co., Cleveland. The smaller machines in the two side bays and all the machines in the core room also were furnished by this company. It will be noted in Fig. 8, that there is a cylinder molding machine located near each end of the two center bays and the remaining machines are grouped in pairs.

Eight floors with a 2-foot gangway between each pair occupy the space between the groups of machines. The cope and drag machines which operate in pairs are not located side by side. Commencing at one end, the first single machine is employed for making drags. The copes for these drags are made on the near machine of the next pair. The adjoining machine makes drags for the second floor and the copes are made on the first machine of the next pair and so on down the line.

Each of the eight floors between the pairs of machines is provided with

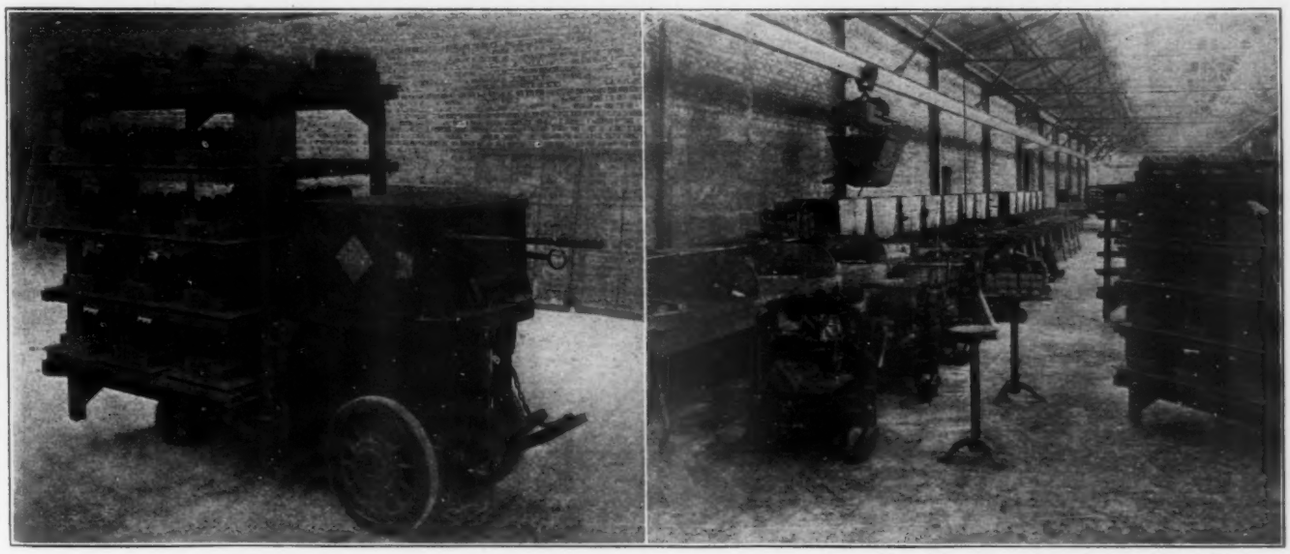


FIG. 9—THE CORES ARE TRANSPORTED INTO AND OUT OF THE OVENS BY STORAGE BATTERY TRUCKS—FIG. 10—A DROP-BOTTOM BUCKET OPERATING ON A MONORAIL IS EMPLOYED FOR FILLING THE HOPPERS ON THE COREMAKER'S BENCHES

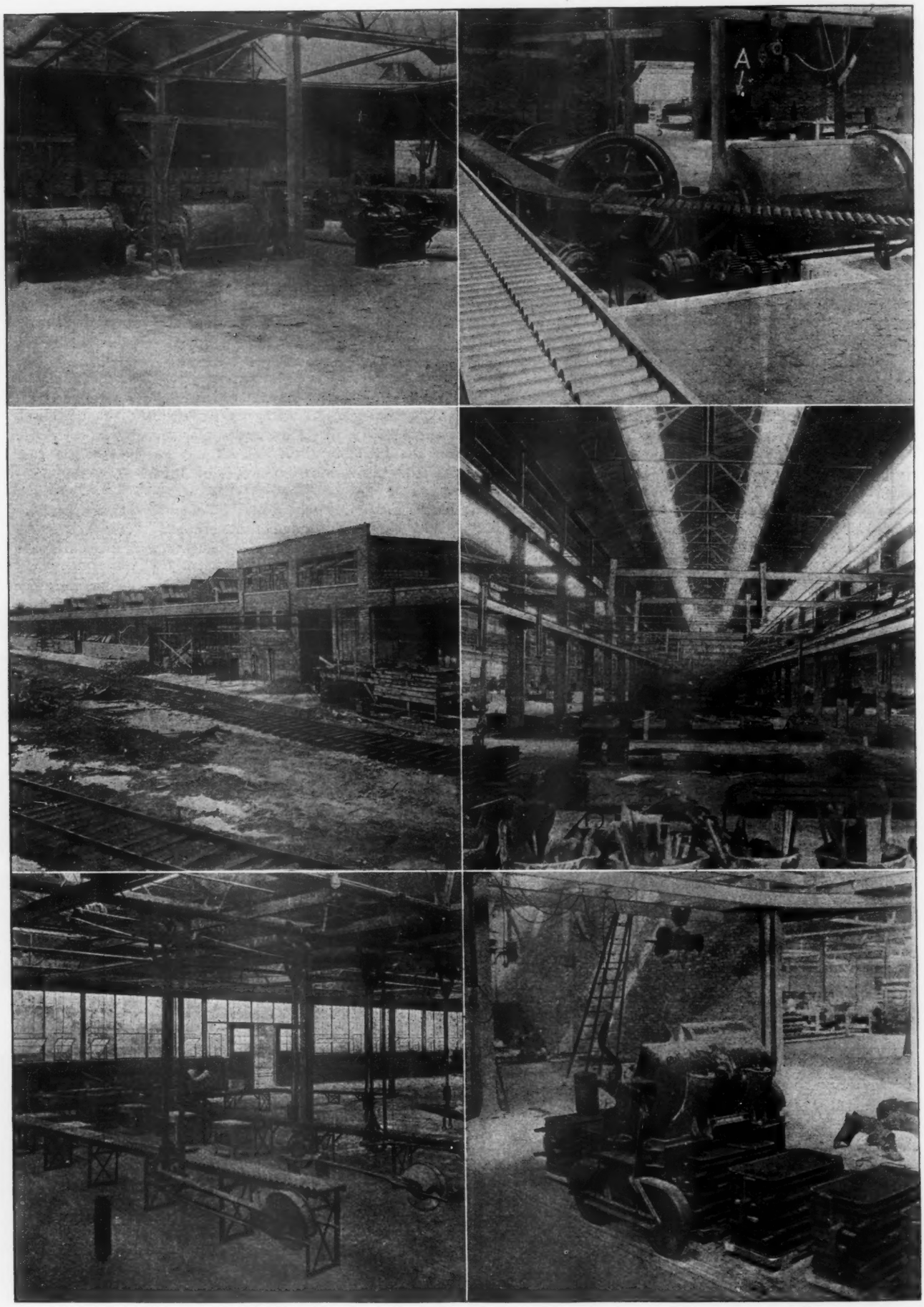


FIG. 11—THE TUMBLING BARRELS FOR THE SMALL CASTINGS ARE ARRANGED IN GROUPS OF FOUR—FIG. 12—THE LOADING PLATFORM ON THE OUTSIDE OF THE CLEANING ROOM—FIG. 13—GRAVITY CONVEYORS ELIMINATE MOST OF THE LABOR IN THE CLEANING ROOM—FIG. 14—THE PORTABLE GRAVITY CONVEYOR FOR CARRYING THE CASTINGS FROM THE FOUNDRY TO THE CLEANING ROOM IS SHOWN PILED UP IN SECTIONS AT *d*—FIG. 15—EIGHT SPECIALLY DESIGNED CRANES SERVE EACH OF THE MOLDING BAYS—FIG. 16—POURING DEVICE FOR FILLING TWO RUNNERS SIMULTANEOUSLY

a narrow gage track, the rails coming level with the floor. The molds are set down between the rails, cored and closed in a straight line and poured with a horizontal semi-cylindrical ladle mounted on a carriage and provided with two pouring spouts as shown in Fig. 16. The device was invented and patented by D. J. Ryan and has been employed satisfactorily for several years in the Allyne-Ryan foundry in Cleveland.

The cylinders are poured through a gate at each end, a method which would involve the services of four men if poured with two double shanks in the ordinary way. The special pouring device can be operated by one man. It holds sufficient iron to pour several molds at one filling; whereas when the molds are poured with shank ladles it is necessary to make a trip to the source of supply after pouring.

A double monorail system embracing both sides of the outside row of columns and passing in front of the cupolas serves to distribute the iron to every floor. Switches, controlled from the floor and located between every second column facilitate passing the ladles from one track to the other. The iron is tapped into a 5-ton mixing ladle resting on a high stand. The bull ladles, suspended from 1-ton electric hoists, are filled from the mixing ladle and then taken to any designated floor and the smaller ladles are filled from them. The hoists, with their loads, are pulled or pushed along by hand and derive their power for hoisting purposes from lengths of extension cord and plugs attached to every alternate column. After the trolley and hoist have arrived at a given point, the nearest plug hanging from an extension cord is inserted, thus supplying the hoisting mechanism with the necessary current to operate. When it is desired to move the hoist to another location, no attention is paid to the plug which disengages itself automatically when the cord has been extended to its limit.

Cranes Are Quick-Acting

The cranes which span three of the foundry bays were designed by D. J. Ryan especially for this plant. As will be noted in Fig. 15, they are of particularly light, but yet rigid construction. The bridge consists of a single piece of 8-inch I-beam suspended at each end from a carriage of two channels face to face the whole structure being carried on exceptionally large wheels, 22 inches in diameter. The wheel bearings, and in fact all similar parts of all the equipment in the plant, are provided with Hyatt roller bearings. The side braces and tie rods add strength and rigidity to the apparently light bridge structure and the large wheels and roller bearings insure ease of motion and rapidity of travel. One of these cranes is located over each floor and serves a cope and drag machine. Pipes for supplying air to the hoist cylinders are attached to the columns. A section of hose, long enough to reach from one column to the next, is employed to connect the upright air pipe with a lenght of 1-inch pipe which extends to the center of the bridge. Another section of hose serves to carry the air to the cylinder. In this way two minimum lengths of hose take the place of the long unwieldy lengths usually employed on cranes of this character. A 1-ton Curtis pneumatic hoist is suspended from each crane.

Several Uses for Cranes

In addition to pneumatic cranes over each individual floor each of the two center bays is provided with a 5-ton electric traveling crane. Special features incorporated in the construction of these cranes make them particularly rapid in their action. They have a hoisting speed of 70 feet a minute and a bridge travel of 350 feet a minute.

When the monorail becomes congested, the traveling cranes are available for transporting metal from the cupolas to any part of the shop. They are also used in connection with the Wadsworth sand cutting machine for piling the sand. The sand cutter leaves the sand in long windrows although it can be used to pile it if necessary, and the crane with the aid of a grab bucket, is employed to pile it near the machine. Also, it is frequently necessary to transfer a quantity of sand from one part of the shop to another. The crane and bucket method is much more economical and a great deal faster than the wheelbarrow method. Another job for which the cranes are particularly well adapted is that of piling flasks into high stacks. The pneumatic cranes are hung low for ease of operation and, therefore, are not in a position to lift flasks to any considerable height.

An exterior view of the foundry building is shown in Fig. 12 and also in the headpiece illustration. It will be noted that the side walls are largely constructed of steel sash the lower sections of which are hung on pivots to aid in ventilation. The walls are of brick and the framework of steel throughout. The roof, which extends longitudinally over the molding section of the foundry is of Truscon truss design provided at the apex of the angles with top hung sash and also at the second step. The glass in the roof is reinforced with wire mesh. All other parts of the roof are covered with Federal cement tile.

Hand Trucking Eliminated

Several Matthews gravity conveyors take the place of hand trucks and wheelbarrows in the transportation of the castings from the casting floor to the shipping platform. A portable conveyor extending from the center of the foundry through the door and into the cleaning room is employed for the first step of the journey. This conveyor is set up at night after the day gang has left the shop. The flasks are shaken-out by the pneumatic cranes and the castings are picked up by the overhead traveller and dropped on to the conveyor. They move along by gravity until they reach the end of the conveyor where they fall off close to a grating shown in Fig. 8.

The loose sand and cores are knocked out of the castings and fall through the grating onto a wide conveyor belt which continues under the floor and finally emerges at the end of the building where it passes over a magnetic pulley that separates the wires, rods, gaggers, and pieces of scrap from the sand. No attempt is made to recover any of the sand. When operating at capacity it is estimated that the amount of refuse sand handled in a day will amount to about one-and-a-half cars. A second grating is located in the floor about halfway between the tumbling barrels and the end of the building. It is not so large as the first grating and is provided as a convenience in keeping the floor clean. It is proposed to sweep all refuse from around the tumbling barrels and grinding stands onto this grating where it will fall through onto the conveyor belt and be carried out to the dump.

Grinding and Chipping Made Easy

The cleaning room equipment is laid out in two units. One unit is shown in Figs. 8 and 11. It comprises a battery of six large rectangular tumbling barrels and eight smaller cylindrical barrels supplied by the W. W. Sly Mfg. Co., Cleveland. A small crane, equipped with an electric hoist is provided for each pair of the large barrels while a smaller crane does similar duty for each group of four of the smaller barrels.

The floor of the cleaning room is paved with creosoted wood blocks. The foundations for the machines and the pits in which the large mills are located are concrete. For convenience in loading and unloading the large mills, they have been set up in pits

which bring their center lines a little above the floor levels. These pits are built in the shape of a capital L. Four barrels are located in the long section and two barrels in the part corresponding to the base of the letter. The mills are grouped in pairs, each pair driven by a 15-horsepower General Electric motor. They can be driven in pairs or singly by the manipulation of a clutch arrangement on the shaft. The mills, Fig. 11, were photographed before the pipes leading to the dust arrester were connected.

After the castings have been in the tumbling barrels a sufficient length of time, the covers are removed by the cranes. The castings are then lifted out and dropped on the conveyor located alongside. This conveyor takes them to the swinging grinding stands, shown in Fig. 13. When the castings have been ground they are placed on the gravity conveyors which deliver them to the chipping benches. From the chippers they go to the cross conveyor at the end. Here they are lifted off and water-tested, the defective castings being discarded and those that pass the test are replaced on the conveyor which finally lands them near the shipping room door for final disposition.

A flat, endless belt type of conveyor, which was not in place at the time the photograph of the mills illustrated in Fig. 11 was taken, will be installed over each group of four of the small tumbling barrels. The discharge end of the conveyor will be at the end facing the double grinding stands. A man standing here takes the castings off the conveyor which travels at a speed of 32 feet a minute, and throws them, according to their classifications into a number of piles near each of the grinding stands. Men stationed at these stands grind the castings assigned to them and throw them into barrels. This method is rapid and avoids confusion. The work is easily kept track of and the men develop remarkable speed as a result of concentrating on one job. All the work in the shop is handled on a piecework basis.

The iron is melted in two Whiting cupolas located side by side and served by one elevator and charging platform. Each cupola is 90 inches in diameter inside the shell, but is lined to 72 inches. On account of the method employed of tapping the iron into mixer ladle from which the bull ladles are filled, the cupolas are set up on legs, 7 feet high. A short iron ladder leads up to the platform on which the cupola tender stands while engaged in tapping. A cast iron platform provided with a hand rail, encircles the wind box. The brick lining is contracted and forms a protecting shelf immediately above the tuyeres which are approximately 6 inches square and with the exception of the supporting blocks between, extend in a continuous line around the interior of the cupola.

The blast for the cupolas is furnished by two positive pressure blowers installed by P. H. & F. M. Roots Co., Connersville, Ind., each driven by a 65-horsepower, General Electric motor. The blast pipe from each blower is connected to each cupola by two branches, but there is also a common blast main connecting the two main pipes leading to each furnace. Suitable gates in these pipes makes it possible to switch either blower to the opposite furnace, if necessary.

The cupola charges are lifted to the charging floor by an Otis elevator and also by means of a one leg gantry crane which operates over the stock yard and discharges its burden on to a platform, 15 x 45 feet. The platform is an extension of the charging floor from which it is separated by two large doors provided for protection against inclement weather.

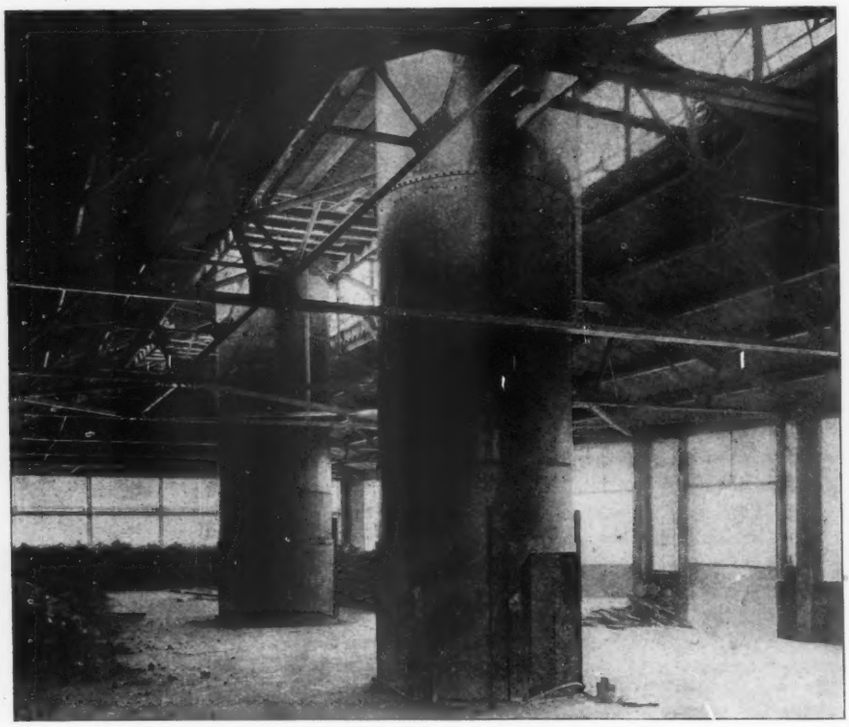


FIG. 17—THE CUPOLAS ARE PROVIDED WITH THREE CHARGING DOORS EACH, A FEATURE WHICH INSURES UNIFORM CHARGING

Method of Charging the Cupola

Instead of the usual one or two charging doors, the cupolas in the Ryan-Bohn foundry are provided with three. The doorways are each 4 x 5 feet and are provided with perforated sheet iron doors which slide up and down in angle iron guides. It is claimed that this arrangement is more convenient than the usual hinge connection. The door sills are almost flush with the charging floor and are reinforced by sill plates set at an angle which serve the double purpose of engaging the lip of the charging truck and of sliding the charge past the brickwork forming the lining.

The bed charge of coke weighs 4000 pounds; on this is charged 4000 pounds of iron and the succeeding charges of coke and iron weigh 650 and 4000 pounds, respectively. The several component parts making up the iron charge are loaded on low trucks which are wheeled by hand over to the charging doors and dumped.

Among the advantages claimed for cupola can be charged faster and that the charges are more evenly distributed. Each cupola will hold eight charges when filled to the charging door before the wind goes on. The cupolas are unusually high measuring 65 feet from the floor level to the top of the shell and are lined with fire brick to the extreme top. In common with the other units of the plant, the charging room is amply lighted and ventilated. The blowers and motors are located on a mezzanine floor immediately below the charging platform. The door is kept locked and the key of the door is retained by the head melter.

As will be noted by referring to Fig. 8, one end of the cleaning room has been partitioned off to serve as a machine shop and pattern shop. It

is equipped with the necessary tools for working in wood and metal and will take care of the making and repairing of patterns and flasks as well as other incidental repairs to equipment around the plant.

Adjoining the machine shop are two rooms containing the power plant and switch boards. The complete electrical equipment was installed by Hatzel & Buehler, Inc., New York. Electric current is supplied by the municipal power plant of Lansing at 4000 volts and enters a switch house separated from the other buildings by about 100 feet. This switch house is provided with protective devices against lightning and the main fuse with protective fuses for the underground service to the building. In case of emergency, the current can be completely shut off from the plant in this building.

Modern switchboard equipment is contained in the switchboard room from which all light and power feeders radiate to the various parts of the building where points of distribution are provided.

Three transformers are employed. One, 300-kilovolt ampere, 4000-400 volts for power and two 100-kilovolt ampere 4000-220/110 volts for light. Three phase is employed for power and single phase for light.

The compressor room is equipped with two 145-horsepower synchronous General Electric motors direct-connected to Ingersoll-Rand twin compressors with air and steam cylinders 17 x 14 and 10½ x 14 inches, respectively. These motors are also used to automatically adjust the power factor. Provision has been made for a third or spare set. Motor-generator sets and control panels for battery charging and lifting magnet also are located in this room. The switchboard room and compressor room are adjacent and the operating attendant is constantly in touch with both outfits. Bell signals have been provided to indicate the opening of any oil switch circuit breaker which might affect the foundry operations.

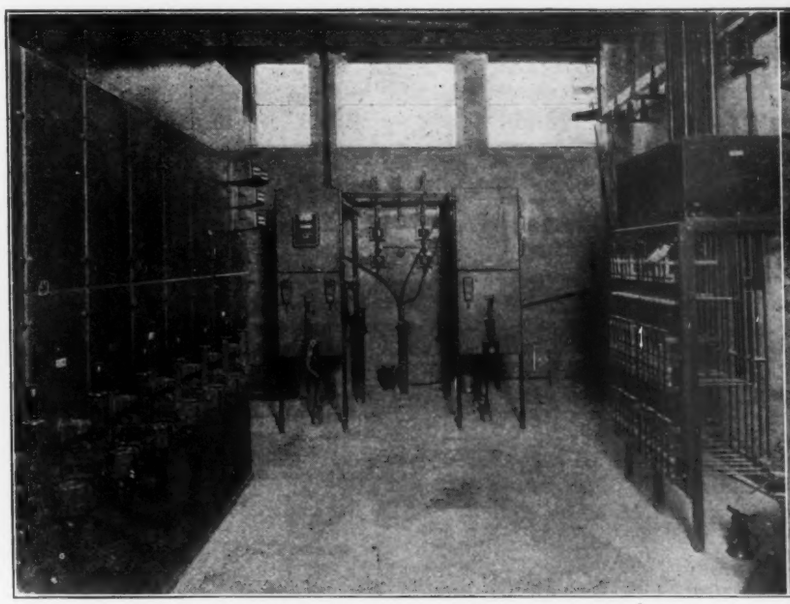
The power distribution panels throughout are of a polarity type with adjustable fuse gaps in each compartment. This feature allows for grouping of any size motors under control of a panel without additions.

Starting boxes and compensators for the tumbling barrels, grinders, sand mixers, etc., are all provided with push button controls supplied by the Industrial Controller Co., Milwaukee, thus eliminating danger to careless workmen. So far as possible, each part of the electrical installation is independent of the others and an accident or breakdown to one part will not affect the others or prevent them from functioning.

The main air line is 6 inches in diameter, this serves several 4-inch lines which in turn are tapped by 1-inch lines all over the plant. Each connection to a branch feeder is taken from the upper side of the pipe and, in addition, drain cocks and water traps are located at various points to keep the air free from water. The lines leading to the chippers benches are laid under the floor and openings, covered with iron plates when not in use, are provided at convenient intervals for connecting the hose to the air line.

Considering the important part cores play in the production of automobile engine castings, it is not surprising to find that the core room occupies practically as much space as the foundry. This core room covers an area of 140 x 300 feet and extends across the end of the foundry and cleaning room. The floor is concrete and its smooth surface is insurance against the jarring of the cores while in transit on the storage battery trucks supplied by the Elwell Parker Co., Cleveland.

Almost all the light in the core room is transmitted through the roof. One wall serves as a partition between the sand storage and the core room, the opposite wall is between the core room and foundry and machine shop. The girls' rest room and general store room occupies the space across one end and the foundry office is located at the other end. The roof is nearly all glass and is of the same general construction as that over the cleaning room. Artificial light is supplied by a number of 300-watt lamps so distributed that 1¼ watts are available for each square foot of floor area.



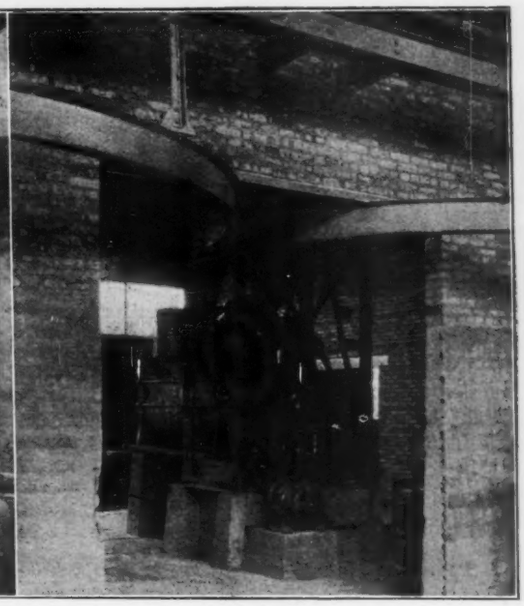


FIG. 18—SHOWING GENERAL ARRANGEMENT OF THE SWITCHBOARD ROOM—FIG. 19—ONE OF THE TWO SAND MIXING UNITS

The cores travel in a straight line from the coremaker's bench to the molding floor. The ovens are in the center of the floor. The cores are made on a row of benches situated on the far side of the ovens from the molding shop. They are loaded on racks and placed in the ovens by storage battery trucks. After they are dried they are taken out by the same trucks and set down on the near side of the ovens. They are taken off the racks, gaged, pasted and assembled and then stacked up in tiers ready to be delivered to the molders.

The three batteries of core ovens were erected and installed by Holcroft & Co., Detroit. Each battery is made up of eight ovens built four and four back to back. Each oven measures 11 x 5 x 7 feet and is designed to hold two rack loads of cores. The

ovens are fired with coke and are provided with fans which supply forced and induced draft. These features and the position of the flues and manipulation of the dampers insure the high rate of efficiency claimed for these ovens. The induced draft in particular adds to the comfort of the employes in the core room as it drives all the noxious fumes up the chimney. The firing chamber is in a pit, lined with concrete and is about 10 feet deep. An iron trap door leads to a ladder into the pit for the use of the fireman and another close by covers the opening through which the coke is dumped for the fires. The fan for supplying the forced draft discharges through a pipe into the firing pit. Before the fan is set in motion, the two trap doors are closed and the only egress for the air from the fan is through or over the fire and into the flue.

A large, brick-lined flue extends under the ovens and discharges the heat into each oven through two rectangular openings in the floor close to the division wall. The floor of the oven is made up of five channels laid in open formation on three similar channels built into the wall on each side. An open space under the iron floor forms an air chamber through which the air is drawn by two openings in the side walls near the bottom of the chamber. Directly above the openings in the bottom are two additional openings near the roof of the oven. All the openings are provided with damper plates which can be manipulated from the outside of the oven and the heat in the oven regulated. A pyrometer is connected to each oven through the roof and readings are taken from time to time to determine the temperature.

Sand Mixing and Conveying Machinery

The sand storage parallels the core room and is only separated from it by a brick wall. It is divided into four compartments containing respectively, molding sand, core sand, two sand mixing units manufactured by the Standard Sand Mixing Machine Co., Cleveland and silica sand. A monorail encircles the core room with branches running into the molding sand bin and into the sand mixing room. Buckets suspended from the monorail are employed for transporting the sand to the core makers benches and also into the foundry. The core benches are provided with hoppers and it is claimed that one man can keep them filled with the aid of a drop bottom bucket.

The coremakers' bench with its cast iron row of pigeon holes and wooden hopper is one of the many special kinks designed by A. P. Vreeland, general superintendent of the foundry.

The Ryan-Bohn foundry, the latest to be added to the automobile casting producing plants, is capitalized at $2,000,000. Edward Ver Linden, president, is vice president of the General Motors corporation and president and general manager of the Olds Motor Works, Lansing, Mich.; D. J. Ryan, vice president and general manager, is also president and general manager of the Allyne-Ryan Foundry Co., Cleveland, and the D. J. Ryan Foundry Co., Ecorse, Mich.; C. B. Bohn who is also largely interested in the company is president of the Aluminum Foundry Co., Detroit.

Display Refractories

One of the displays at the Sixth Annual Chemical show in the Grand Central Palace which particularly interested foundrymen was that of Buckman & Pritchard, Inc., Mineral City, Fla., showing refractory shapes and other products made of zirconium silicate. This mineral which is relatively new in the industrial world is mined near Jacksonville, Fla., where it is found as the mineral zircon. Until comparatively recently, this ore has been placed with the group of so-called rare earths, but previous to the war the German chemists had exploited deposits found in Brazil. Manufacture of refractory material with this mineral as a base has now developed in this country to a far greater extent than ever before. The manufactured product is used for brass and steel melting crucibles, for bricks for lining furnaces and for any other foundry use where resistance to high temperature is needed. It is said to have a melting point of over 4600 degrees Fahr. and that its incorporation into any clay or silica mixture imparts thereto the quality of being more resistant to changes of temperature, thus helping to cut down the spalling losses.

Company Will Specialize in Plumbers' Goods

Among the more recent incorporations is that of the Hart Co., Williamsport, Pa., capitalized at $100,000 and incorporated under the law of the state of Pennsylvania. The incorporators are Walter Hart, Harry A. Miller, LeRoy W. Gleason, Harry E. Speaker, William S. Carson, Edgar R. Munson and Harry S. Kolb, all of Williamsport. The company will manufacture a complete line of brass and bronze faucets, valves, basin cocks, etc. The factory is completely self contained having its own foundry with forced draft furnaces, molding machines, sandblast installation, etc. In addition to its regular line of work the company is in a position to handle contract work ranging in size from an ounce to 50 pounds. The machine shop is equipped with modern machines and has special equipment for making tools and patterns. The buffing and polishing department is on a par with the other units of the plant.

Novel Shipping Cases

An interesting feature in connection with the display of the Wadsworth Core Machine & Equipment Mfg. Co., Akron, O., at the Columbus convention was the manner in which the different units comprising the exhibit was shipped from the factory to the place of exhibition. A number of packing crates were prepared on the knock down plan. The four sides, top and bottom of these packing crates were made separately and provided with means for joining them together by a number of pins. They were assembled at Akron and packed. Upon reaching the fair grounds at Columbus they were taken apart, the integral parts utilized to form part of the booth furniture and the contents arranged in an attractive manner. When the show was over they were knocked down, reassembled, packed and shipped back to their destination.

Engineers Plan to Join General Federation

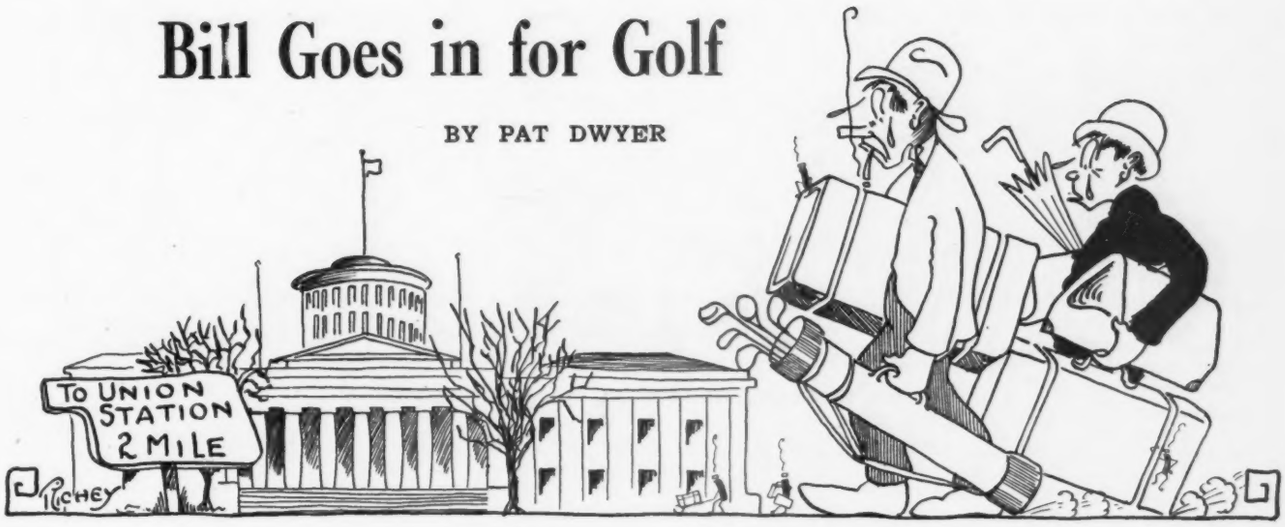
The American Engineering council met in New York on Sept. 1 and issued a call on the various engineering societies to join a combined organization to be known as the Federated American Engineering society. They were given approximately two months in which to register their votes and signify their willingness to join. The first meeting of the federation will be held about the middle of November.

The federated societies, it is planned, shall represent the 200,000 odd members of the various individual engineering societies now in existence, and its plan is to have it devote its energies to the interpretation of national economic issues in the terms of engineering, bringing a greater class consciousness into being. The *ad interim* committee of the organization conference of which Richard L. Humphrey is chairman is instructed to work for the creation of the federated society.

Representatives of the engineering and technical papers were present at a meeting of the organization held in New York on Wednesday, Sept. 8, at which the general scheme of the new organization was explained and plans made for the November meeting.

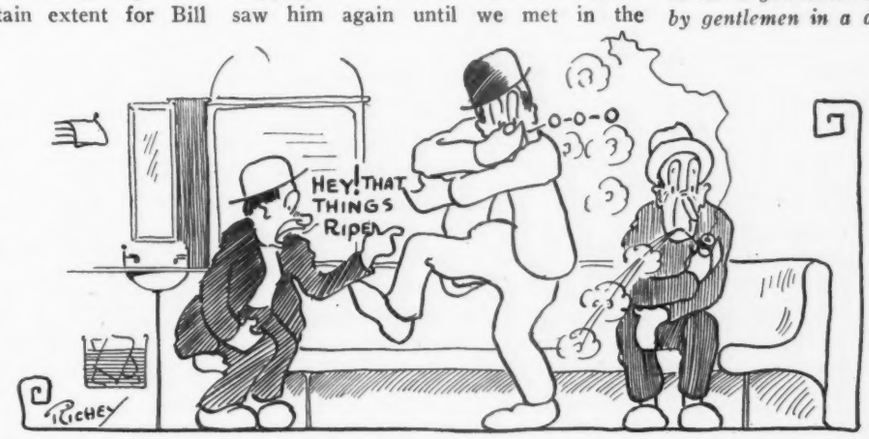
Bill Goes in for Golf

BY PAT DWYER



BILL and I went down to Columbus together to see the convention. I am not sure whether the word *see* is the proper one to employ or not for after we had reached the grounds where the convention and exhibition were held we *heard* a great deal more than we *saw*. Perhaps I should qualify that statement to a certain extent for Bill contributed his share by hailing old friends and comrades-in-arms in practically every building which we entered. I often think that he missed his calling or rather that he arrived in the world too late, although in all fairness the latter charge cannot very well be held against him. Standing with feet wide apart on the wave-swept deck of one of the old time clippers as she logged off her 20 knots in a half gale crossing the westen ocean, Bill would have been in his element shouting orders to his trusty crew to go aloft and "cut away the raffle with their clasp knives in their teeth." I don't know why they should cut away the raffle, indeed for that matter it never was clear to me why anyone should want to hold a raffle away up among the spars and things when there was a perfectly comfortable cabin on the ship in which they might have held the entertainment in comparative comfort. However, I have read the phrase so often in deep sea yarns that for lack of proof to the contrary I accept it.

Be that as it may, Bill's fog horn voice stood him in good stead at the exhibition especially in the buildings devoted to the showing of the air compressors and the power operated molding machines. He even stopped for a while in the sand blast section and exchanged reminiscences with his old friend Tom Pangborn. He stayed so long in some of the booths that finally I left him and strolled off alone and although we were stopping at the same hotel I never saw him again until we met in the Union station to take the train for home. He kept the most unearthly hours and how he kept awake is a mystery to me.



THEY SPOKE NOT A WORD AND THEY SAID NOT A PRAYER BUT THEY LEFT HIM ALONE IN HIS GLORY

We secured seats in the Pullman smoker and having comfortably settled back he proceeded to fill an old clay pipe that smelled to high heaven with some villainous tobacco which he assured me was the nearest approach to Montreal twist he had been enabled to secure since leaving Canada and then he related some of his experiences.

He fell in with a harum-scarum gang like himself from Cleveland and Detroit and among their other activities they organized a golf tournament.

He confided to me in confidence that the rules and regulations were drawn up originally by a friend of Mike Sweeney's, you know Mike with the beautiful teeth and the auburn hair. He extracted several typewritten sheets from his grip and asked me to look over the following extraordinary proclamation:

Founders' Golf Tournament

Kicker's Handicap: One Brown Derby
RULES AND REGULATIONS GOVERNING PLAY

Preamble: Golf is popularly supposed to be a gentlemen's game to be played by gentlemen in a discreet and decorous manner. It is earnestly hoped that the participants in this tournament will bear this fact in mind at any and all times and regulate their conduct accordingly. Rule No. 1— Play invariably shall start from No. 1 tee and end at No. 18 green, on one and the same day. No skipping of holes shall be allowed. A person who feels like skipping has not the proper temperament for a golf player and should devote his energies to skipping the rope, skipping out to avoid legal complications, or join the grasshopper brigade.

Rule No. 2—Stepping on an opponent's ball is allowable only when one is reasonably sure that his opponent is looking the other way and has no knowledge of the action. In no case shall a ball be stepped on more than once during the playing of each hole. Under no circumstances shall a player step on his opponent's ball while on the putting green. The attention of members providentially supplied by nature with big, side-stepping feet is particularly directed to this ruling.

Rule No. 3—The rule pertaining to the replacing of turf and the filling in of foot prints in bunkers may be ignored during the progress of this match. A corps of expert sodders and levelers has been engaged to follow closely upon the heels of the players to look after this rule. A secret service man will be present to see that these men are not

tampered with in the discharge of their duties. Should any player strike oil during the round of play he shall be penalized four strokes and the results accruing from the sale of the well shall be divided *pro rata* among the members of the foursome of which he is a member, according to their standing at the time of the lucky strike.

Rule No. 4—Talking on driving tees prohibited except during the time an opponent is addressing his ball and making his stroke. At all other times absolute silence is requested. The only exception to this rule is in the case of Bill Gruss. It is felt that in asking Mr. Gruss to adhere strictly to this rule too great a handicap is placed upon him. Therefore he is granted the privilege of talking at all times.

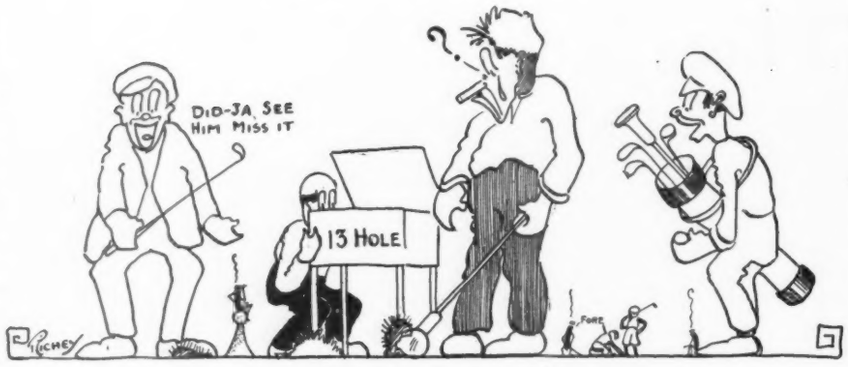
Rule No. 5—Should any member desire to riddle his own sand for teeing purposes, same will be entirely satisfactory; but no member shall be allowed to bring his tumbling barrels. This objection is raised owing to the terrific noise which would result, making it utterly impossible for Mr. Gruss's opponents to hear what he might wish to say.

Rule No. 6—Dan Ryan, if he chooses may use a hand ladle, lined or unlined, for putting on the greens, provided he exercises a reasonable amount of care not to drop it on his opponent's feet, accidentally or otherwise.

Rule No. 7—Filling putting cups with hard-rammed sand or baked cores to prevent an opponent from holing out will not be tolerated, whether in person or by bribed deputy.

Rule No. 8—Throwing plumbago or soapstone in an opponent's eyes while he is in the act of driving or putting will not be permitted. Making a noise like a cork also is ruled out under the same or similar circumstances.

Rule No. 9—Should any controversies arise during the course of play, no player shall be allowed to use any weapons other than his own fists to inflict corporal punishment on his opponent. It readily can be seen that a well aimed sprue or gate may render a player unfit for further participation in play. Dropping a lump of pig iron on an opponent's back from the limb of an adjacent and friendly tree as he bends over a difficult shot is also prohibited. Tapping-bars and sledge hammers must be emptied out of each player's bag at the club house before play commences.



BILL THINKS HE COULD DO BETTER WORK WITH A SHOVEL

Rule No. 10—Wagers must not be made in terms of money. This term embraces scads, bucks, bones, spondulix, iron men, long green, kale and mazuma. The only medium of exchange recognized in the tournament will be fly wheels, pig iron, motors or cylinder blocks.

Rule No. 11—Hiding in ditches or behind trees and darting out with the object of diverting his attention while an opponent is making a stroke will not be tolerated. Using this method as an act of self protection is allowable. Sneaking up behind an opponent and shouting in his ear through a megaphone is no longer considered *au fait* on the best gold courses.

Rule No. 12—No iron or wooken flasks will be allowed on the course. Glass flasks may be employed several times during the heat. Not less than one or not more than four men shall be allowed to work on any one flask.

HELPFUL HINTS

Don't keep your eye on the ball. Keep it on your opponent for he may put his ball in your eye.

Keep strict count of Bill Gruss's strokes. His memory—at times—and under exciting circumstances, is inclined to be a trifle faulty.

Don't wear spiked shoes. You may ruin your opponent's ball; besides the spikes leave marks by means of which your identity may be disclosed.

Put a rammer in your bag. Your opponent's ball may happen to fall on hard turf where the weight of your body may not be sufficient to embed it far enough into the ground. Two or three discreet and vigorous strokes of a butt rammer may cause your opponent more than two or three strokes to extract it. Bring along a hand bellows. Should your ball run up to the lip of the cup and then stop, it may be useful in blowing it in. The club refuses to assume any responsibility for members who lose their way after passing the nineteenth hole.

Cracking an opponent on the shins while he is engaged in putting, is not considered good golf etiquette. However, should an opponent's action warrant one in pursuing these tactics, it is suggested that one of the iron clubs be employed for the purpose.

A player who is off form for any reason may call at any time upon Mike Sweeney for advice. Hence the popular expression, "Tell it to Sweeney." Mike will be glad to analyze his play and offer suggestions for improving the same. Should your play be a trifle sluggish he will doubtless recommend increasing the phosphorus content in your stroke.

"Of course y'understand," said Bill, "I didn't spend all my time in Columbus playing golf. I played several other games of a somewhat more lively character, if you get my meaning, and I also managed to see the exhibition and to attend most of the technical sessions.

I heard some No. 1 oratory both humorous and otherwise at the banquet Wednesday and afterward danced with some of the handsomest ladies who ever graced a foundryman's gathering. The smoker held on Thursday night was a bear, no, not bare; but bear, the word of course being used in a colloquial sense, if I have to explain everything to you in words of one syllable; and then on Friday, everything was finished for another year and here we are homeward bound and believe me I am thankful I am not leaving it the way I did back in the '90s, on the brake beams."

EVERY MEMBER CARRIED HIS OWN BELLOWS TO FURNISH AIR—HOT AND OTHERWISE—AT CRITICAL MOMENTS

How and Why in Brass Founding

By Charles Vickers

Aluminum Alloy Suitable for Kitchen Ware

We would like to learn what aluminum alloy is the best for castings for frying pans, skillets, stew pans and large kettles. We are not satisfied with the mixture we are now using and will appreciate any information you may be able to give us.

The following alloy is considered very good for the purpose stated: Commercial *pure* aluminum, 95.50 per cent; nickel, 1.50 per cent; copper, 1.50 per cent and magnesium, 1.50 per cent. To make this alloy use an alloy of 50 per cent copper and 50 per cent nickel which can be purchased the same as other brass foundry alloys. Melt any given quantity of this alloy and add an equal amount of aluminum, then ingot. Use this alloy as a hardener melting 6 per cent with 92½ per cent aluminum, stir thoroughly and add the magnesium.

The more pure the aluminum is the better for cooking utensils. When the alloy contains much zinc, the utensils turn black in service. The copper-aluminum alloys find extensive application but are not as suitable as the preceding mixture, as the copper aluminum constituent of the alloy may be dissolved by food acids thus contaminating the food with copper.

To Brass Plate Aluminum

We would like to obtain information relative to aluminum castings that must take a brass plating and polish. Is there any special mixture that is more adaptable for this purpose than others? We have been advised by some of our friends that aluminum castings cannot be brass plated; while others claim that by incorporating certain alloys with the aluminum the castings will take a brass finish. The aluminum castings have to be of low specific gravity.

Aluminum can be plated but the difficulty is to get the plating material to adhere and not peel off. The aluminum first would require to be copper plated, and a deposit of copper can be made to adhere. There would then be no difficulty in depositing a coating of brass on the copper. As the castings are for chandeliers, why not use aluminum bronze? This material has a lower specific gravity than yellow brass or red brass. Aluminum bronze would not require electroplating as the polished surfaces resemble gold. The weight saved by making chandelier castings of aluminum appears to our understanding to be so insignificant, it is not worth the effort of disguising them as brass. An alloy of copper 8 per cent, aluminum 92 per cent would be suitable for such castings, as its specific gravity is lower than that of the alloys containing zinc. From a plating standpoint, one aluminum alloy is just as good as another, provided the greater portion of the alloy is aluminum. No particular difficulty is experienced for instance, in plating aluminum bronze.

Proper Solder Mixtures

We would like to obtain a standard formula for solder. We have been supplying an alloy of 75 per cent tin and 25 per cent lead which we claim is a hard solder, but have been informed the higher the tin, the softer the solder. We are unable to see the matter in that light as we are of the opinion that tin hardens the metal.

The hardening effect of tin on lead bears no similarity to the effect of tin on copper which is probably what was in mind in forming the theory that tin acts as a hardener of tin lead alloys. Tin is slightly harder than lead as shown by the Brinell test. Tin has a hardness of 4.1, and lead a hardness of 3.9. Therefore, the difference is slight. The hardness of the alloys of tin and lead is greater than that of either metal. With 10 per cent of tin, lead has a hardness number of 10.1 but an alloy of 75 per cent tin, 25 per cent lead has a hardness only represented by the number 15.4. The alloy of greatest hardness contains 66 per cent tin and 34 per cent lead. This is also near the eutectic alloy, that it is the best flowing solder. We suggest a mixture of half lead and half tin, in place of the one being used. This alloy has a hardness of 15, or about the same as the mixture being used. A harder solder can be made by the addition of antimony to the mixture. However, the amount of antimony should not exceed 1.5 per cent.

Melting Aluminum Bronze

We are having difficulty in making aluminum bronze castings using the alloy containing 1 per cent of iron and 10 per cent aluminum. We are unable to get the alloy uniform; also shrink holes and air holes occur inside the castings, although the surface would indicate they are solid. In making the alloy we first melt the copper and iron, then add half the aluminum about 5 minutes before the pot is removed from the furnace, the remainder of the aluminum is added after the pot is out of the furnace. The metal is thoroughly mixed with a stirring rod before it is cast.

To make a uniform alloy of aluminum bronze, it is necessary to melt the alloy twice. The first melt should be ingoted. Then the ingots should be remelted for the castings. The shrink holes may be avoided by placing properly sized risers on the casting, or by chilling the places that shrink.

Air holes can be avoided by regulating the pouring temperature. Aluminum bronze should not be poured until it has cooled from the increased temperature produced by the reaction of the aluminum as it dissolves in the copper. For this reason it is better to add all the aluminum to the copper while the latter is in the furnace, then allow a short period; about 5 minutes, for the gases to escape from the bronze. The pot should then be removed and poured.

Brass Valves and Stems

We desire a formula for the metal suitable for making brass or bronze valves, 2 and 3 inches in diameter. These valves are used on gasoline tanks and the castings must machine easily, and have good wearing qualities. We also would like to obtain a formula suitable for the stems of these valves.

The following makes a good alloy for bronze valves: Copper, 86 per cent; tin, 7 per cent; lead, 3 per cent, and zinc, 4 per cent. This alloy will machine easily and has good wearing qualities. It is used for the body part of the valve. For stems a cheaper mixture can be used as follows: Copper, 87 per cent; zinc, 7.25 per cent; tin, 4.25 per cent, and lead, 1.50 per cent.

THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

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Advance in Subscription Necessary

FOR the first time in its twenty-seven years of existence, THE FOUNDRY has found it necessary to advance its subscription price. In September, 1892, when the first issue was published, the subscription rate was set at one dollar per year, and this nominal charge for twelve copies remained unchanged despite the growth in the size and scope of the paper through succeeding years. When the periodical was changed to a semi-monthly basis in April, 1919, an additional charge of one dollar was made to cover the twelve additional copies which each subscriber received, bringing the annual rate to two dollars. Therefore, the advance to three dollars per year on Oct. 1, represents only 50 per cent increase over the first price established when the publication was a mere leaflet in size. The reasons for the advance in price are not far to seek for anyone at all familiar with prices and manufacturing conditions. The past few years have seen a steady and rapid advance in the cost of paper and all the materials which enter into the production of a magazine. Wages in the printing trades, also have been raised to keep pace with other lines. Further, and more directly affecting the publication in its relation to its readers, the postal zoning system and advance in the costs of delivery have brought an additional burden which is added to every copy mailed to more remote points. Under the new subscription rates, the price of THE FOUNDRY for one year, mailed to any point in the United States and possessions, to Cuba or Mexico, is three dollars per year.

Theory Must be Made Practicable

CHEMISTRY has revolutionized the mixing practice in foundries and now few if any foundrymen would use iron in their cupola unless they knew its composition, at least approximately. After chemistry had found an introduction in both ferrous and nonferrous foundries the microscope came into recognition and many theories were built around the revelations of this instrument. Along with silicon, sulphur and the other chemical elements which became familiar to the metallurgical chemist, pearlite, ferrite, cementite and other metallographical terms became a part of his necessary equipment. Complicated theories regarding the state of the carbon in the iron were founded on the different structures shown by the microscope, until now the highly trained metallurgist seems almost to live in a different world from the administrative foundryman. Metal is mixed in the average foundry according to the amount of silicon, sulphur, phosphor and manganese reported to be confined by the different lots of pig iron, the determining factor being the information derived from the metallurgical study of the metal together with the results of practical experience. However, the theoretical man has advanced far beyond this point and finds that even the microscope is too crude an instrument to supply the required information demanded by the profound students, and the X-ray spectrometer is being called into use. All this theorizing will undoubtedly be of use if it does not lead to confusion. One of the dangers of too highly theoretical training is that the student may be led away from the practical application of his theories and it may be well for the foundryman to follow his present course regardless of theories which are not proved. Encourage research but do not accept conclusions blindly.

Trade Outlook in the Foundry Industry

SLACKENING demand still is apparent in many foundry lines. Jobbing shops which were crowded with orders and many of which were obliged to refuse business within the past six weeks now report a shrinkage in contracts on their books and but little new business in sight. Automobile and tractor inquiry is at a minimum. Implement business still is active, but with indications that an early contraction may be felt through the slump in demand incident to falling prices of farm products. Railway buying has not yet made its appearance to relieve the situation, although repair castings are being purchased in large quantities.

Railroads Not Buying

It was expected early this spring that the railroads of the country would enter the market with the $300,000,000 revolving fund made available through an act of congress and that the inquiry arising from the locomotive and car business would serve to give employment to many foundries. However, this has not come to pass and the high interest rates and prevailing prices have served to deter the railway officials from purchasing as was expected. During the past eight months, including August, the railroads of the country are reported to have placed orders for approximately 65,000 cars. Coal cars lead in the number placed. However, the general tendency in railway equipment demand is shown by the case of the New York Central. This road has repaired and returned to service over 100,000 freight cars. It is said that the number of cars conserved by this company is more than eight times to total of new units purchased in the period of eight months mentioned. In a statement dealing with the efforts which 27 roads are making to increase the average freight car mileage and tonnage, the Association of Railway Executives reports that more freight is being moved more miles than ever before. Further, the number of bad order cars is being reduced, and the roads are getting heavier loadings and quicker handling by shippers. The increase in efficiency during the past few months has had the same effect as would the addition of some 260,000 new cars. Therefore, it is evident that railway castings are not likely to be a factor in foundry operation soon if present motive power and cars prove adequate.

Prices of Raw Materials for Foundry Use

CORRECTED TO OCT. 11

Iron		Scrap	
No. 2 foundry, valley	$47.00	Heavy melting steel, Valley	$26.25 to 26.50
No. 2 Southern, Birmingham	42.00 to 43.00	Heavy melting steel, Pittsburgh	28.00 to 28.50
No. 2 Foundry, Chicago	46.00 to 47.00	Heavy melting steel, Chicago	22.00 to 23.00
No. 2 Foundry, Philadelphia	49.25 t o52.25	Stove plate, Chicago	30.50 to 31.50
Basic, Valley	48.50	No. 1 cast, Chicago	32.00 to 32.50
Malleable, Chicago	46.50	No. 1 cast, Philadelphia	38.00 to 40.00
Malleable, Buffalo	51.25	No. 1 cast, Birmingham	32.00 to 33.00
		Car wheels, iron, Pittsburgh	43.00 to 44.00
		Car wheels, iron, Chicago	37.00 to 37.50
Coke		Railroad malleable, Chicago	27.50 to 28.00
Connellsville foundry coke	$18.00 to 18.50	Agricultural malleable, Chicago	27.00 to 27.50
Wise county foundry coke	19.00 to 19.50		

Materials Easier

With the improvement in railway operations, foundries are having little difficulty in securing all the raw materials that they desire. Coke, pig iron, scrap and sand are being delivered in many cases as fast as plants can handle them. This factor, coupled with the slackening demand has brought a softening in practically all foundry materials. A slight exception was noted during the past week when the car supply in the Connellsville region was poor and prices reacted. A waiting attitude on the part of buyers of pig iron is evident throughout the country. While no immediate expectation of a drop in price is noted, the general feeling seems to prevail that future buying in quantity is unnecessary. Unusually prompt shipments on immediate demand have served to strengthen this condition. Pig iron production for September showed a slight increase. According to figures compiled by *The Iron Trade Review* the daily rate for September was 104,166 tons as compared with 101,469 tons for the previous month. For the 30-day month, the total of iron produced by all stacks was 3,145,536 in comparison with 3,145,536 tons produced in the 31 days of August. Reflecting the condition in the foundry industry to a certain degree, the merchant iron output was slightly less. The average daily production of merchant furnaces was 26,441 tons for September which is but slightly less than the August figure of 26,565 tons. Cancellations and deferred deliveries still are being received from consumers, particularly in the automotive industries. This condition obtains in most sections. In the East, despite cancellations of orders, foundrymen are operating at about 75 per cent of capacity on general gray iron castings, although machine tool and automobile work has dropped away. In the South, sanitary pipe plants are fairly active, but cast iron pipe foundries are not optimistic. St. Louis reports jobbing business exceedingly slack with a sharp shrinkage in unfilled orders, while there is less inquiry for malleable castings than previously. Malleable plants throughout the country report the cancellation and deferred delivery requests outnumbering new orders. Railroad inquiry for repair castings has been active until recently when a decrease has been noted. Increased freight rates, coupled with the increased costs of raw materials, fuel and refractories threaten to bring about an advance in price of malleable castings. One large interest reports that this increase may make a difference of from $15 to $18 per ton between castings produced in the fourth quarter and those delivered in the third quarter of this year. While some plants undoubtedly will find it advisable not to increase their prices at this time, the advance in costs will bring a closer margin of profit. Brass foundries also are experiencing a reduction in the demand for their products. Prices for nonferrous metals based on New York quotations of Oct. 11, follow: Casting copper, 17.00c; lead, 7.65c to 7.75c; Straits tin, 41.75c to 42.00c; antimony, 6.75c to 7.00c; aluminum, No. 12 alloy, producers price, 34.00c and open market, 26.00c to 27.00c. Zinc is quoted at 7.25c to 7.35c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

MAJ. R. A. BULL, who recently resigned from the Duquesne Steel Casting Co., Coraopolis, Pa., of which he was vice president, has been employed by a group of six steel casting manufacturers in the capacity of consulting metallurgist and for the primary purpose of developing and perfecting higher standards in the production of steel castings in the foundries operated by these manufacturers. The members of this group of steel casting producers are as follows: Electric Steel Co., Chicago; Fort Pitt Steel Castings Co., McKeesport, Pa.; Isaac G. Johnson & Co., Spuyten Duyvil, N. Y.; Lebanon Steel Foundry, Lebanon, Pa.; Michigan Steel Castings Co., Detroit; Sivyer Steel Castings Co., Milwaukee.

Joseph W. Jirsa has been made assistant secretary and treasurer of the Automotive Foundry Co., LaCrosse, Wis.

Henry A. Powis recently became sales representative at Chicago for the Betts Machine Co., Inc., Rochester, N. Y.

Charles H. Smith, formerly with the R. D. Nutall Co., recently became sales manager of the Allegheny Gear Works, Pittsburgh.

James A. Carr, Richmond, Ind., formerly president of the American Seeding Machine Co., Springfield, O., recently was elected chairman of the board.

Charles G. Bancroft, president of the International Trust Co., Boston, has been elected a director of the United Shoe Machinery Corp. of that city to fill a vacancy.

James Hartness, president of the Jones & Lamson Machine Co., Springfield, Vt., has been nominated by the Republicans as a candidate for governor of that state.

A. A. Loeffler recently was appointed by the Doehler Die-Casting Co., Brooklyn, N. Y., as its Detroit representative, succeeding F. C. Steeger, who will now represent the company on the Pacific coast, with headquarters in San Francisco.

Joseph G. Tew, Phenix, R. I., who has resigned as supervisor of mechanical training at the Taft-Peirce Mfg. Co., Woonsocket, R. I., builder of special machinery, has gone to Manhattan, Kans., as assistant professor in mechanical training at the Kansas State college.

F. J. Weigle, who has been associated with the advertising department of the Mesta Machine Co., Pittsburgh, has resigned to become associated with the publicity department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and has been succeeded by W. L. Ingersoll.

Edward D. Kinney has been engaged as instructor in metallurgy by the Norton Co., Worcester, Mass., for its school of instruction. He has been chief chemist with the Edison Storage Battery Co., Silver Lake, N. J., the past six months, previous to which he was in the metallurgical department of the Anaconda Copper Mining Co., of Montana.

MAJ R. A. BULL

William H. Leonard recently has been elected vice president and general manager of the Imperial Brass Mfg. Co., Chicago, manufacturer of oxy-acetylene welding equipment, plumbing supplies, automoible accessories and jobbing brass castings. Until recently Mr. Leonard was associated with Belding Brothers & Co., Chicago.

Among the visitors from over seas present at the American Foundrymen's convention held in Columbus the week of Oct. 4-8 were Rupert H. Pickles, of T. H. Pickles & Sons, Mytholmroyd, near Halifax, England; Edward Forrest, director of the K. F. B. Foundry Co., Ltd., Sydney, Australia, and A. E. Hurst, Samuel Russel & Co., Ltd., malleable iron founders, Walsall, England.

H. W. Hutchinson, of Winnipeg, who has been elected a director of the Cockshutt Plow Co., Brantford, Ont., is well known in western business circles but has also been associated with a number of eastern Canadian industrial and financial enterprises. He is vice president of the Sawyer-Massey, Ltd., Hamilton, a director of the Dominion bank, and president of the Consolidated Mortgage Co., Winnipeg Trust & Mortgage Co., Mortgage Investors Co., and other companies.

Prof. H. M. Boylston, formerly teacher at Harvard and Columbia universities, has been elected professor of metallurgy and head of the mining department at Case School of Applied Science, Cleveland. Professor Boylston was graduated from Harvard in 1903. He took his master's degree in metallurgy at Harvard in 1905. The next year he was private technical assistant to Prof. Henry M. Howe, Columbia university. Then for six years he taught metallurgy and metallography at Harvard under Prof. Albert Sauveur. In 1915 Professor Boylston was awarded the Carnegie research scholarship by the British Iron and Steel institute. Professor Boylston retains his connection with Sauveur and Boylston, Abbott building, Cambridge, Mass., metallurgical engineers.

Major Bull has an international reputation as an authority in metallurgy and foundry practice as applied to steel casting manufacture. Prior to his affiliation with the Duquesne Steel Foundry Co., Major Bull was manager of the steel foundry of the Commonwealth Steel Co., Granite City, Ill. His activity in the steel foundry industry covers a period of more than 20 years and he has served in various capacities such as chemist, superintendent, manager, etc. His headquarters will be established at Sewickley, Pa. In the world war Major Bull was attached to the ordnance department and served overseas about a year. He is a member of a number of technical societies and he has been unusually active in the affairs of the American Foundrymen's association, of which he has been a director since 1911, and he served two years as its president in 1961 and 1917, and while in this office aided in starting the exhibits as a branch of the association.

Fred J. Passino, formerly assistant

ALUMNI OF THE McLAIN SCHOOL MEET AT THE FOUNDRYMEN'S CONVENTION

district manager of the New York territory for the Independent Pneumatic Tool Co., Chicago, has recently been appointed District manager at Pittsburgh.

Henry P. Bluemenauer, vice president and general manager of the Arcade Malleable Iron Co., Worcester, Mass., and John Jordan, its superintendent, before leaving to attend the twenty-fifth annual convention of the American Foundrymen's association in Columbus, O., Oct. 4-8, were each presented with a traveling bag by associates in the various departments throughout the plant.

Will Make High Grade Aluminum Castings

The new plant of the Light Alloys Co., manufacturers of aluminum castings, at Painesville, O., is now in operation. The equipment provided is adequate for the production of both light and heavy work up to a total capacity of 10,000 pounds a day. A sales office will be maintained after Oct. 15 in the seventy-first Euclid building, Cleveland.

Foundry School Students Hold Session

About 200 graduates of the correspondence foundry course of instruction conducted by McLain's System Inc., Milwaukee, Wis., together with prominent foundrymen, personal friends of Mr. McLain and their ladies, attended a luncheon served in the club house on the Fair grounds at Columbus on Wednesday, Oct. 6.

The meeting was the result of a movement launched by the members who tendered Mr. McLain a complimentary dinner in Philadelphia one night during the convention of the American Foundrymen's convention in that city last year. On that occasion it was suggested that the alumni form an association and a committee was appointed to get in touch with the 3000 or more students scattered all over the world and arrange for an annual meeting to be held coincident with the convention of the American Foundrymen's association in whatever city that body elected to hold its meetings.

Owing to the hour chosen for the luncheon, the interest manifested by those present in the technical sessions held in adjacent buildings, no lengthy addresses were delivered by any of the gentlemen present. The gathering was just a sociable affair designed to give the members an opportunity to meet Mr. McLain personally.

Bronze Chinese Castings

John R. Freeman, past president of the American Society of Mechanical Engineers and now connected with the Massachusetts Institute of Technology in charge of improving the water transportation systems of China, in a recent talk on the industry and progress of China mentioned a bronze casting 40 feet high and 20 feet wide which now stands in one of the smaller towns in the southern part of the Far East country. This piece of work he said was beyond the ability of any foundry which he knew today. The exact method of pouring the huge casting is not known but it is thought that the mold was built up in sections on the actual site of the present statue, each section being added as the pouring progressed.

What the Foundries Are Doing

Activities of the Iron Steel and Brass Shops

Erection of a large foundry at Clearing, Ill., is reported being considered by the Advance-Rumely Co., La Porte, Ind. The company is maintaining a temporary office at Clearing with the Standard Steel Casting Co.

Capitalized at $40,000, the Advanced Casting Co., Goshen, Ind., recently was incorporated by E. Schacht, F. W. Bemm and others.

The Eclipse Lawn Mower Co., Sterling, Ill., is erecting a foundry building, 106 x 125 feet.

Articles of incorporation have been filed by the Supreme Foundry Co., Belleville, Ill., with a capital stock of $20,000. The incorporators are N. L. Gransman, E. L. Stonewater and Otto Zottman. The company will manufacture castings and stoves.

The Traction Foundry & Machine Co., Benton Harbor, Mich., has been organized with a capital stock of $80,000, by S. E. Dorster, and others.

The Truck Parts & Foundry Co., Alma, Mich., has been organized and has taken over the plant of the Western Carburetor Co. The company is capitalized at $12,000. The incorporators are H. H. Soule, Charles O. Ward and Harley Williams.

The Leiser Gas Stove Co., Philadelphia, recently was incorporated with a capital stock of $35,000, by William A. Leiser, L. S. Leiser and Walter K. Cook.

The Zero Valve & Brass Corp., Buffalo, recently was incorporated with a capital stock of $25,000, by F. K. and B. H. and C. H. Hyde.

The Doehler Die Casting Co., Brooklyn, N. Y., plans extensions and improvements to its plant.

The Belknap Mfg. Co., 145 Water street, Bridgeport, Conn., manufacturer of brass goods, is reported planning the erection of a plant, 35 x 65 feet.

Ralph Gertsch, Oshkosh, Wis., and several others have purchased the foundry at Waupaca, Wis., operated by Fred Rosche. Repairs and additions will be made and it is expected the plant will be ready for operation within a few weeks.

The Worcester Foundry Co., Worcester, Mass., has let the contract for the erection of an addition to its plant, 60 x 148 feet.

The Star Brass Foundry, Worcester, Mass., recently was organized by William A. Latour, and P. A. Latour, Roslindale, Mass.

Randolph Ember, 11 King street, Brooklyn, N. Y., is having plans prepared for the erection of a foundry building 56 x 96 feet.

Frazer, Brace & Co., 1328 Broadway, New York, has filed plans for the erection of a shop building, 27 x 52 feet and 22 x 51 feet, at its shipyard at Clifton, S. I., to be devoted to brass and copper working.

The Barlow Foundry, Inc., 551 New Jersey Railroad avenue, Newark, N. J., manufacturer of gray iron castings, has plans for the erection of a plant building, 20 x 86 feet.

The Windsor Foundry Co., Windsor, Vt., has decided not to build this year, the addition which it has had under consideration.

The Easthampton Foundry, Easthampton, Mass., will move to Florence, Mass., occupying the plant of the Northampton Iron Works. The latter company will move into the foundry of the former Florence Sewing Machine Co.

The Eastern Malleable Iron Co., Naugatuck, Conn., manufacturer of castings, etc., has completed plans of the erection of an addition to its branch plant at Union City, Conn.

The Roberts & Mander Stove Co., Eleventh and Washington streets, Philadelphia, has awarded a contract to the Austin Co., Cleveland, for the erection of a foundry at Hatboro, Pa., to be 100 x 150 feet. The foundry will be devoted to the manufacture of stove castings.

The addition to be erected at the plant of the Gray Iron Foundry Co., Reading, Pa., will be 160 x 200 feet, and the contract has been awarded to the Austin Co., Cleveland.

The Westinghouse Electric & Mfg. Co., Essington, Pa., has filed plans for the erection of a foundry, 160 x 200 feet, contract for which has been awarded to the Austin Co., Cleveland.

The Scotia Brass Works, Conshohocken, Pa., a new industry, will operate a plant for the manufacture of brass, aluminum and other metal castings. James Inglis heads the company. Chris Seegar, formerly superintendent of the Albion Foundry Co., Conshohocken, Pa., will act in the same capacity at the new plant.

The American Car & Foundry Co., 370 Babcock street, Buffalo, has filed plans for the erection of an addition to its plant, 46 x 75 feet.

The Buffalo Foundry & Machine Co., 1543 Fillmore avenue, Buffalo, has awarded a contract to the Charles Berrick's Sons Co., for the erection of an addition to its plant, 50 x 70 feet.

The Rochester Castings Corp., Rochester, N. Y., is having plans prepared for the erection of a foundry building, 275 x 1000 feet.

E. R. Caldwell & Son, 619 West Fayette street, Syracuse, N. Y., manufacturer of iron castings, etc., has awarded a contract to the Shane Construction Co., for the erection of an addition to its foundry, 50 x 60 feet.

The American Foundry & Construction Co., 4700 Second avenue, Pittsburgh, has taken out a permit for the erection of an addition to its plant.

The Star Brass Works, 3120 Carroll avenue, Chicago has let the contract for the erection of a plant building, 47 x 159 feet.

The Frances Nygre Foundry Co., 2542 Fillmore street, Chicago, has let the contract for the erection of an extension to its plant, 20 x 37 feet.

The Allerton Foundry Co., Niles, Mich., which recently purchased the former plant of the Tate Mfg. Co., is building an addition to the plant, 60 x 60 feet. The company was recently organized with a capital stock of $50,000.

The American Car & Foundry Co., Madison, Ill., has awarded a contract to the Wimmer Construction Co., Victoria building, St. Louis, for the erection of a building, 72 x 161 feet.

The Hagerstown Foundry Co., Hagerstown, Md., manufacturer of iron and steel castings, has perfected plans for the erection of a plant building, 60 x 90 feet.

The Baltimore Malleable Iron & Steel Casting Co., Charles and Wells streets, Baltimore, has awarded a contract to Franle Bros. & Haigley, 18 Clay street, for the erection of an addition to its foundry.

The James J. Lacy Co., Block and Wills streets, Baltimore, iron founder, has awarded a contract for the erection of an addition to its foundry, to R. B. Mason, 208 West Madison street, Baltimore.

The machine and pattern shops of the Tredegar Co., Richmond, Va., recently were damaged by fire. Plans call for their immediate rebuilding.

The American Malleable Co., Owosso, Mich., has awarded a contract to H. K. Ferguson Co., Cleveland, for the erection of a plant building.

The Great Lakes Foundry Co., Port Huron, Mich., has filed plans for the erection of a foundry building to be 50 x 95 feet.

The Waukesha Foundry Co., Waukesha, Wis., has increased its capital stock from $10,000 to $40,000. It manufactures brass and aluminum castings and recently completed the erection of a new plant.

The Pacific Foundry Co., Eighteenth and Harrison streets, San Francisco, has filed plans for the erection of a plant building.

The Pomona Mfg. Co., Pomona, Cal., manufacturer of iron and steel castings, machinery, etc., has completed plans for the erection of a plant building.

The Topeka Foundry & Iron Co., 318 Jackson street, Topeka, Kans., is arranging for the construction of a new plant comprising a general metal works, structural shop, machine shop, foundry, etc.

The American Blakeslee Mfg. Co., Birmingham, Ala., manufacturer of iron and steel products, has plans under way for the erection of a new foundry building.

The Dantzler Foundry & Machine Works, Gulfport, Miss., is reported planning to install some new equipment.

The plant of the Boundary Iron Works, Grand Forks, B. C., was recently damaged by fire. The foundry was completely burned and will be rebuilt at once on a larger scale. John McKie is head of the company.

The Doran Brass Foundry Co., Seattle, has secured a large contract from the Emergency Fleet Corp. for a number of manganese propellers.

The Smith Iron Foundry, Lynn, Mass., is erecting an addition to its plant, 55 x 62 feet. Albert F. Smith is president of the company.

The Rehoboth Porcelain Enameling Co., Taunton, Mass., has been incorporated to engage in the enameling of iron castings, with a capital stock of $100,000, by J. Palmer Barstow, Providence, R. I., Oscar G. Thomas, Eugene L. Baker and T. W. Thomas.

Erection of an addition to its plant is being planned by the Palmer Foundry & Machine Co., Palmer, Mass.

The American Brass Co., Ansonia, Conn., has let the contract for the erection of an addition to its plant, 333 x 400 feet.

The Seymour Mfg. Co., 87 Franklin street, Seymour, Conn., plans the erection of an addition to its foundry.

Henry Wray & Sons, Rochester, N. Y., is having plans drawn for the erection of a brass foundry, 280 x 1000 feet.

The Pittsburgh Casting & Heater Co., Pittsburgh, is reported planning improvements to its plant.

The plant of the Glynrich Brass Foundry, Glynrich, Del., recently was damaged by fire.

A $100,000 addition will be erected by the Kennedy Corp., Baltimore, manufacturer of iron castings, etc. The company is now negotiationg for the required building site.

The United Engineering & Foundry Co., Canton, O., will enlarge its plant.

The Williamson Heater Co., Cincinnati, plans to increase its capital stock from $400,000 to $1,000,000 and is erecting an addition to its foundry.

Work is progressing on the erection of a foundry for the McFadden Foundry & Machine Co., Columbiana, O.

The Superior Castings Co., Dayton, O., has purchased a site on which it plans to erect a foundry.

The Hagan Foundry, Orrville, O., will build an extension to its foundry, according to a report.

The Magnus Metal Co., 4153 Clayton avenue, St. Louis, is reported planning the erection of a foundry building.

Plans are under way for the construction of a foundry building for the Southern Motor Mfg. Association, Ltd., Houston, Tex.

The Enterprise Brass Co., 968 McGarry street, Los Angeles, has plans for the erection of an addition to its foundry.

The Pacific Coast Brass & Mfg. Co., Los Angeles, has been incorporated with a capital stock of $150,000, by W. F. Schultheiss, Frank James and others.

Initial steps to locate at Sheboygan, Wis., have been taken by the Thompson Type Machine Co., 223 West Erie street, Chicago, which has let a contract with the Globe Co., for the manufacture of type casting machines until it is able to erect a plant of its own.

The Western Malleables Co., Beaver Dam, Wis., on Oct. 15 opened its second furnace at its new Center street plant.

The Carr Pattern & Tool Co., Hamilton, Ont., has been incorporated to manufacture, patterns, tools, etc., with a capital stock of $40,000, by John Carr, Robert Christie, John A. Robertson and others.

The Brass Products Co., Detroit, has let the contract for the erection of a foundry and office building to be erected at 1067 Palmer avenue, Detroit.

New Trade Publications

FOUNDRY EQUIPMENT.—The Arcade Mfg. Co., Freeport, Ill., has prepared a 4-page bulletin in which modern foundry equipment is described and illustrated, which includes pouring devices, molding macnines, piston machines, jolters, stripping plate machines and roll over core machines.

ELECTRIC FURNACES.—The Electric Furnace Co., Alliance, O. has published a 32-page illustrated bulletin in which the melting of nonferrous metals and annealing and heat treating in the electric furnace is described. General data pertaining to electric furnaces are given, and the illustrations show the furnaces in actual use.

FOUNDRY FLASKS.—The American Foundry Equipment Co., New York, is circulating an illustrated booklet in which foundry equipment, such as corrugated steel flasks, flask bars, taper snap flasks, snap mold jackets, cast bottom plates and mounting frames are described and illustrated.

LIGHTING.—The Cooper Hewitt Electric Co., Hoboken, N. J., is circulating an 18-page illustrated booklet, containing a treatise on lighting, including the illumination of industrial plants of all kinds. The treatise is entitled "Studies in the Economics of Lighting," and is reprinted from the *Central Station*.

GAS PRODUCER.—The Smith Gas Engineering Co., Dayton, O., has published a 16-page illustrated bulletin, in which a new type mechanically operated installation for the generation and delivery of clean cold gas, is briefly described and illustrated. General data are given.

SWITCHBOARD PANELS.—A bulletin has been issued by the General Electric Co., Schenectady, N. Y., in which standard unit switchboard panels are described and illustrated. In general the panels comprise units for small capacity plants, direct current for one or more generators not larger that 240 kilowatt, for mining service, grounded negative, and for three-wire lighting, grounded or ungrounded; alternating current for 240 and 480 and for large capacity plants, direct current with volts with lever switches, for 480 and 600 volts with oil circuit breakers, for 1150 and 2300 volts, and for series incandescent and series arc service; double polarity, generator and feeder panels, and for railway service up to 1500 volts; alternating current for induction motor starting and controlling, etc. A number of representative switchboards are illustrated in the bulletin.